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✓ ENCYCLOPÆDIA BRITANNICA

REVISED AND AMENDED.

A DICTIONARY OF ARTS, SCIENCES AND LITERATURE

TO WHICH IS ADDED

BIOGRAPHIES OF LIVING SUBJECTS

96 Colored Maps and Numerous Illustrations.



EDITED BY

W. H. DEPUY, D.D., LL.D.

And a Corps of Eminent Writers.

VOL. VI.—GRE—IRN.

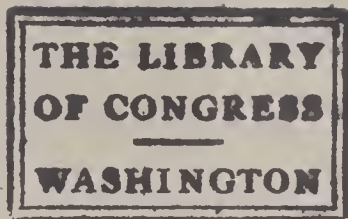


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 Harris, Isham G.
 Harris, Joel Chandler.
 Harris, Samuel.
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 Harrison, Benjamin.
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 Harrison, Carter H.
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 Horsley, John Callcott, R.A.
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 Hosack, David, M.D.
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 Hough, Benjamin F., M.D.
 Hough, George Washington.
 Hough, John Stockton.
 Houghton, Lord (Richard Monckton Milnes).
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 Houssaye, Arsène.
 Houston, David Crawford.
 How, William Walsham, Bishop.
 Howard, Blanche W.
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 Howard, Edward, Cardinal.
 Howard, John E.
 Howard, Oliver Otis, General.
 Howe, Elias.
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 Hughes, John, Archbishop.
 Hughes, Joshua, Bishop.
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Hymers, John, D.D.
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Ibsen, Henrik.
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NEW AMERICANIZED ENCYCLOPÆDIA BRITANNICA.

VOLUME VI.

G R E

GREENSBURG, capital of Westmoreland county, Pennsylvania, thirty-one miles from Pittsburg, on the Pennsylvania railroad. It is the center of a rich agricultural district, and the shipping point for the coal mined in the vicinity. The city contains a court-house, four banks, two daily and seven weekly papers, twelve churches, a high school, graded schools, and a female seminary. The manufactures embrace glass, heating apparatus, iron-pipes and valves, nuts and bolts, carriages, furniture and lumber. Natural gas is used for heating and lighting, and electric railways are successfully operated. Population (1890), 6,000.

GREENVILLE, the capital of Washington county, Mississippi, and one of the most progressive cities between Cairo and New Orleans, is situated on the Mississippi river, 140 miles from Vicksburg, and 260 miles from Memphis. It is also on the Georgia Pacific and Louisville, New Orleans and Texas railroads, and the center and shipping point of the richest cotton growing country in the State. The city is handsomely laid out, and financially, socially and commercially enjoys a widely extended reputation. It contains one daily and five weekly papers, also a monthly magazine, four banks, a court-house, churches, schools, fine hotels and private residences characterized by beauty of design and finish. The manufactures embrace a foundry and machine shop, cotton-seed-oil works, saw mill, cotton compress, etc. Population, 6,655.

GREENVILLE, capital of Greenville county, South Carolina, is situated on Reedy river, and on the Richmond and Danville and the Central Georgia railroads, 141 miles from Columbia, the State capital. The surrounding country is devoted to the cultivation of cotton on an extensive scale, of which Greenville is the shipping point. The city is lighted with gas, is provided with street railway facilities, and contains a number of handsome public buildings and private residences. It is also the location of Furman Univer-

sity, the Greenville Military Academy, the Baptist Female College, and other institutions of learning; contains three banks, one daily and four weekly papers, a court-house, ten churches, five hotels, and some lines of manufacture. Population (1890), 8,607.

GREENVILLE, county seat of Darke county, Ohio, is situated on the Cincinnati, Jackson and Mackinaw, Dayton and Union, and Pittsburgh, Cincinnati and St. Louis railroads, ninety-four miles west of Columbus, the State capital. The city is centrally located and in a highly prosperous condition, containing three banks, five weekly papers, twelve churches, a high school, also union schools, a large number of stores, and manufacturing industries, embracing foundries and machine shops, tile works, carriage repositories, wringer and broom factories, etc. Population (1890), 6,200.

GREENVILLE, capital of Hunt county, Texas, is on the Missouri, Kansas and Texas railroad, in the midst of a prosperous and highly cultivated portion of the State. Four weekly papers are published here, and there are two national banks. The city contains a court-house, six churches, schools, stores, warehouses, and manufactures of lumber, lumber products, etc. A large business is carried on in the compressing of cotton for shipment to foreign ports. Population (1890), 5,000.

GREENE, MAURICE, an English composer, was born in London toward the close of the seventeenth century. He died September 1, 1755.

GREENE, NATHANIEL, an American general, was born at Potowhommet, Warwick county, Rhode Island, May 27, 1742. From his early years he was employed in assisting his father in the conduct of his business as iron forgemaster, but he succeeded, notwithstanding this, in acquiring a large amount of general information, and made a special study of mathematics, history, and law. At Coventry, where he removed to take charge of a forge of his own, he was the first to

establish a public school; and in 1770 he was chosen a member of the legislature of Rhode Island. Sympathizing strongly with the revolutionists, he in 1774 joined the "Kentish Guards," and on this account was expelled from the Society of Friends. In 1775 he was appointed to the command of the contingent of 1,000 men raised by Rhode Island, and after joining Washington before Boston he was named brigadier-general. In 1776 he obtained the rank of major-general, and accompanied Washington to New Jersey, where he took part in the battles of Trenton and Princeton. At the urgent request of Washington he in 1778 accepted the office of quartermaster-general, on the understanding, however, that he should retain the right to command in the field, a right of which he took advantage at the battle of Monmouth, 24th June of the same year, and at the battle of Springfield, June 23, 1780. In August following he resigned his office, and on the 2d of December he succeeded Gates in the command of the Southern army. At the beginning of the campaign he detached General Morgan to attack the enemy at Cowpens, with a result that was brilliantly successful. Then followed a series of clever retreats to avoid engaging superior forces, until he deemed himself strong enough to attack the enemy at Guilford Court House; and although he here suffered tactical defeat, the British army a few days afterward retreated toward Wilmington. After following a short distance in pursuit he changed his line of march, and advancing into South Carolina attacked Lord Rawdon at Camden, and again suffered a defeat. But this reverse also failed to impede his energy, and after capturing a number of forts he again engaged Lord Rawdon at the battle of Eutaw Springs, which, though a drawn combat, resulted in the British abandoning South Carolina. For his services in the campaign he was presented with two pieces of captured ordnance, a British standard, and a gold medal. Georgia and North and South Carolina also made him valuable grants of land. He died from sunstroke at his estate, Mulberry Grove, Savannah, June 19, 1786.

GREENE, ROBERT, dramatist and miscellaneous writer, was born at Norwich about the year 1560. He died September 2, 1592.

GREENFINCH (German *Griinfink*) or GREEN LINNET, as it is very often called, a common European bird, the *Fringilla chloris* of Linnæus. No species of Greenfinch is found in America.

GREENHEART, one of the most valuable of timbers, is the product of *Nectandra Radiæi*, natural order *Lauraceæ*, a tree which grows to the height of 70 feet, native of Guiana, where, inland, it exists in great abundance. The Indian name of the tree is Sipiri or Bibiru, and from its bark and fruits is obtained the febrifuge principle Bibirine (see BIBIRINE).

GREENLAND, or GRÖNLAND, is the name applied to a large continental island, the greater portion of which lies within the Arctic Circle, and all of which is arctic in character. It is entirely unconnected with any portion of Europe or America, though in the extreme north only separated from the latter by the narrow strait which lies between it and the outlying portion of America known as Grinnell Land. From Europe it is divided by the North and Greenland Seas—the Faroe Isles, Jan Mayen Island, Iceland and part of Shetland being the only lands between it and Norway. Denmark Strait is the sea between it and Iceland, and it is more than probable that Spitzbergen is the only great group of islands lying to the east of its northern portion. On the west, Davis Strait and Baffin's Bay sepa-

rate it from the opposite shore. The exact northern termination of Greenland is not known, the country never having been doubled on the north.

On the east coast, Cape Bismarck, in $76^{\circ} 47'$ N. latitude, marks the limit of exploration; though as early as 1670 Lambert is said to have sighted land several degrees further north. From Cape Bismarck south to Cape Farewell ($59^{\circ} 35'$ N. latitude) the coast is very imperfectly known, whole stretches being entirely uncharted, even in the rudest fashion. This arises from the Spitzbergen ice-stream continually pouring down that shore, rendering it possible to approach within sight of it only on rare occasions, and to land still more rarely. A number of islands are dotted over the chart here; but there are few "ice fjords," the slope of the inland ice being evidently chiefly toward the west coast. The west coast is of much the same character,—only, on this side, the fjords with which it is intersected have been nearly all followed to their heads. The Greenland fjords, like those of Norway, British Columbia, and other countries with a western exposure, bear every mark of having been at one time the beds of glaciers, when the climate and physical geography of the country were different from what they are at present. The country cannot be said to be mountainous, yet heights of from 3,000 to 4,000 feet are common. There are one or two still higher points, such as Petermann's Peak, near the shores of Franz Josef Fjord on the east coast (11,000 feet), Payer's Peak, Sukkertoppen, and the familiar Sanderson's Hope.

Excluding the extreme northern parts of Greenland, and the northeast coast,—which may be claimed by the English, American and Germans "by right of discovery,"—the trade of Greenland is a strict monopoly of the Danish crown, dating from 1774, and is at present administered in Copenhagen by a government board—the "Kongelige Grönlandske Handel,"—and in the country by various officials in government pay. In order to meet the double purposes of government and trade, the west coast, up to nearly 74° N. latitude, is divided into two inspectorates,—the southern extending to $67^{\circ} 40'$ N. latitude, the northern comprising the rest of the country,—their respective seats of government being at Godthaab and Godhavn. These inspectorates are ruled by two superior officials or governors responsible to the director of the board in Copenhagen. Each of the inspectorates is divided into "districts," each district having in addition to the capital or "coloni" (a hamlet containing three or four Danish dwellings, a storehouse, blubber-boiling house, in a few cases a Lutheran "missionair" or clergymen, a teacher, and a physician), several outlying posts and Eskimo hunting stations, each presided over by an "udligger," who is responsible to the "colonibestyrrer" or superintendent of the district. These trading settlements, which dot the coast for a distance of 1,000 miles, are about 60 in number, and collect the products from 176 inhabited places. From these Eskimo hunting and fishing stations blubber is the chief article received.

GREENLEAF, SIMON, American jurist, was born at Newburyport, Massachusetts, December 5, 1783. After studying law in Massachusetts and Maine, he began in 1806 to practice at Standish in the latter State, proceeding finally to Portland in 1818. There, after two years, he became reporter of the supreme court of Maine, and during his twelve years of office published nine volumes of *Reports*. Resigning in 1832, Greenleaf became in 1833 Royale professor, and in 1846 Dane professor of law in Harvard University,

where he received the degree of doctor of laws. He retired in 1848 from his active duties, becoming emeritus professor, and after being for some years president of the Massachusetts Bible Society died at Cambridge, Mass., October 6, 1853.

GREENOCK, a seaport town of Renfrewshire, Scotland, on the south bank of the Firth of Clyde, twenty-two miles below Glasgow. The principal industries are shipbuilding and sugar refining. Many of the steamers of the Cunard Company, the Peninsular and Oriental Company, and the Allan Line have been built at Greenock. Population (1890), 85,000.

GREENOUGH, HORATIO, an American sculptor, son of a Boston merchant, was born at Boston, September 6, 1805. At the age of sixteen he entered Harvard College; but while there he devoted his principal attention to art, and in the autumn of 1825 he went to Rome, where he enjoyed the advantage of instruction from Thorwaldsen. After a short visit in 1826 to Boston, where he executed busts of John Quincy Adams and other persons of distinction, he returned to Italy and took up his residence at Florence. Here one of his first commissions was from James Fenimore Cooper for a group of *Chanting Cherubs*; and the success of his work, joined to the strong recommendation of Cooper, Dana, Everett, and others, led to his being chosen by the Government to execute the colossal statue of Washington for the national capital. It was unveiled in 1843; and as an accurate likeness, conceived in a lofty and truly poetical spirit, it is entitled to high rank among modern works of a similar kind. Shortly afterward he received a second commission from Government for a colossal group, the "Rescue," intended to represent the conflict between the Anglo-Saxon and Indian races. In 1851 he returned to Washington to superintend its erection, and in the autumn of 1852 he was attacked by brain fever, of which he died December 18th.

GREENSHANK, one of the largest of the birds commonly known as Sandpipers, the *Totanus glottis* of most ornithological writers. The Greenshank is a native of the northern parts of the Old World, but in winter it wanders far to the south, and occurs regularly at the Cape of Good Hope, in India, and thence throughout the Indo-Malay Archipelago to Australia. In North America it is represented by two species, *Totanus semipalmatus* and *T. melanoleucus*, there called Willets, Telltales, or Tattlers, which, in general habits, resemble the Greenshank of the Old World.

GREENWICH, a market-town and parliamentary borough in the county of Kent, England, is pleasantly situated on the right bank of the Thames, six miles southeast of London Bridge by the river. Fronting the river stands the splendid range of buildings in the Grecian style of architecture, formerly known as Greenwich Hospital, but now the Royal Naval College. It occupies the site of an ancient royal palace called Greenwich house, which was a favorite royal residence as early as 1300, but was granted by Henry V. to Thomas Beaufort, duke of Exeter, from whom it passed to Humphrey, duke of Gloucester; and it did not revert to the crown till his death in 1433. It was the birthplace of Henry VIII., Queen Mary and Queen Elizabeth. The building was enlarged by Edward IV., by Henry VIII., who made it his chief residence and named it *Placentia*, by James I., and by Charles I., who erected the "Queen's House" for Henrietta Maria. Along with other royal palaces it was at the revolution appropriated by the Protector, but it reverted to the crown on the restoration of Charles II., by whom it was pulled down, and the west wing of the present hospital was erected as part of an extensive design which was not further car-

ried out. In its unfinished state it was assigned by the patent of William and Mary to certain of the great officers of state, as commissioners for its conversion into a hospital for seamen. As it now stands, the building consists of four blocks. Behind a terrace eight hundred and sixty feet in length, stretching along the river side, are the buildings erected in the time of Charles II. by Webb from Inigo Jones' design, and in that of Queen Anne from designs by Sir Christopher Wren; and behind these buildings are on the west those of King William, and on the east those of Queen Mary, both from Wren's designs. In the King William range is the painted hall.

Another of the attractions of Greenwich is the park, 190 acres in extent, in which is situated the Royal Observatory. It was inclosed by Humphrey, duke of Gloucester, in 1433, and laid out by Charles II. It still contains a fine avenue of Spanish chestnuts planted in his time; and the hill rising toward the south commands a fine prospect over London, the Thames, and the plains of Essex. The Royal Observatory was built in 1675, for the advancement of navigation and nautical astronomy. From it the exact time is conveyed at one o'clock every day by electric current to London and all other chief towns of the kingdom; and English geographers reckon longitude from its meridian. Population of town (1890) 50,000; of parliamentary borough, 180,000.

GREENWICH, a city of Fairfield county, Connecticut, is beautifully situated on Long Island Sound, and on the New York, New Haven and Hartford railroad, thirty miles from New York city. It contains two banks, one weekly paper, Greenwich Academy, high and graded schools, churches, and manufactures of lumber, stoves, screws, etc. The city now (1890) has a population of 10,120.

GREGOIRE HENRI, bishop of Blois and French revolutionist, was born at Vého near Lunéville, December 4, 1750. After studying at Metz and Nancy, he became curé of Embermesnil and professor at the college of Pont-à-Mousson. He was chosen in 1789 by the clergy of the district of Nancy to represent them in the states-general, where he took a leading part in the deliberations, and gave energetic support to the republicans. As a member of the national assembly he proposed the motion for the abolition of the kingly office, which was carried by acclamation. During the trial of Louis XVI., being absent with other three colleagues on a mission for the union of Saxony to France, he along with them wrote a letter urging the condemnation of the king, but omitting the words *à mort*; and he endeavored to save the life of the king by proposing in the assembly that the penalty of death be suspended. He opposed the national renunciation of Christianity, and was the first to advocate the reopening of the churches; exerted himself to get measures put in execution for restraining the vandalistic fury against the monuments of art; extended his protection to artists and men of letters, and obtained for them pecuniary encouragement from the state; and devoted much of his attention to the reorganization of the public libraries, the establishment of botanic gardens, and the improvement of technical education. He also took a great interest in negro emancipation, and on his motion men of color in the French colonies were admitted to the same rights as whites. On the establishment of the new constitution, Grégoire was elected to the council of 500, and after the 18th Brumaire he became a member of the new legislative assembly. In this capacity he voted in the minority of five against the proclamation of the empire, and opposed the creation of the new nobility and the

divorce of Napoleon from Josephine; but notwithstanding this he was subsequently created a count of the empire and officer of the legion of honor. During the later years of Napoleon's reign he traveled in England and Germany, but in 1814 he had returned to France and was one of the chief instigators of the action that was taken against the empire. After the second restoration he was excluded from the Institute, and when in 1819 he was elected to the assembly by the department of Isère, his election was annulled. From that time, therefore, he lived in retirement, occupying himself in literary pursuits and conducting a voluminous correspondence with most of the eminent savants of Europe; but as he had been deprived of his bishopric and of his pension as a senator, he was compelled to sell his library to obtain the means of support. He died at Paris, May 20, 1831.

GREGORIAN CHANT. See PLAINSONG.

GREGORAS, NICEPHORUS. See BYZANTINE HISTORIANS.

GREGORY, ST., surnamed THE GREAT, the first pope of that name, and one of the four doctors of the Latin Church (Ambrose, Augustine, and Jerome being the other three), was born at Rome about the year 540. His father Gordianus possessed senatorial rank, and his mother Sylvia is said to have been remarkable for her mental endowments. Educated for the legal profession, Gregory about his thirtieth year was chosen by the citizens to the high position of prætor urbanus; this post he is said to have occupied for three years (571-574). About 578 or 579 he was appointed abbot of his monastery, and likewise one of the seven deacons (regionarii) of the Roman Church; and in 582 he was sent by Pelagius II. to Constantinople as papal apocrisiarius or responsalis at the imperial court. There he found time to begin, if not to complete, one of his large works, the *Moralia*, or exposition of the book of Job. A few years after his return from the eastern capital, the death of Pelagius (590) caused a vacancy in the papal chair, and the choice of the clergy, senate, and people unanimously fell upon Gregory. The pontificate of fourteen years which followed was marked by extraordinary vigor and activity, which made themselves felt throughout almost every department of the doctrine, discipline, and worship of the entire Western Church. The aggressions of the Lombards were checked, and order and tranquillity were speedily restored to Rome; in Italy and France he tightened the too long relaxed reins of ecclesiastical discipline; in England, Spain, and Africa the powers of Paganism, Arianism, and Donatism were perceptibly weakened; as against the eastern emperor and patriarch of Constantinople the prerogatives of the bishop of Rome were asserted with a vigor previously unwitnessed; the ceremonies of the church were regulated and extended, the liturgy further developed. The anniversary of Gregory's death, which took place at Rome on March 12, 604, is observed as a duplex by the Latin Church, and even in the Greek Church his wisdom and sanctity continue to be commemorated.

GREGORY II., ST., pope from 715 or 716 to 731, succeeded Constantine I. Having, it is said, bought off the Lombards for thirty pounds of gold, he used the tranquillity thus obtained for vigorous missionary effort in Germany, and for strengthening the papal authority in the churches of England and Ireland. By excommunicating Leo the Isaurian, he prepared the way for a long series of revolts and civil wars, which tended greatly to the establishment of the temporal power of the popes. He died in 731, and subsequently attained the honor of canonization, February 13th being the day consecrated to his memory in the *Martyrology*.

GREGORY III., ST., pope from 731 to 741, a

Syrian by birth, succeeded Gregory II. in March, 731. His pontificate, like that of his predecessor, was disturbed by the iconoclastic controversy, in which he vainly invoked the intervention of Charles Martel. During his reign also Boniface in Germany, on whom he conferred the pallium, Wilibald in Bohemia, and Bede in England carried on their most successful missionary labors. He died November 29, 741, and was succeeded by Zacharias I.

GREGORY IV., pope from 827 to 844, was chosen to succeed Valentinus in December, 827, on which occasion he recognized the supremacy of the Frankish emperor in the most unequivocal manner. His name is chiefly associated with the quarrels between Lothaire and Louis the Debonaire, in which he espoused the cause of the former, for whom, in the Campus Mendacii, as it is usually called (833), he secured by his treachery a temporary advantage. The institution of the feast of All Saints is usually attributed to this pope. He died January 25, 844, and was succeeded by Sergius II.

GREGORY V., pope from 996 to 999, a grandson of the emperor Otho the Great, succeeded John XV. when only twenty-four years of age, and until the council of Pavia (997) had a rival in the person of the antipope John XVI., whom the people of Rome in revolt against the will of the youthful emperor Otho III., Gregory's cousin, had chosen. The most memorable acts of his pontificate were those arising out of the contumacy of the French king, Robert, who was ultimately brought to submission by the rigorous infliction of a sentence of excommunication. He died suddenly, and not without suspicion of foul play, February 18, 999. His successor was Silvester II.

GREGORY VI., pope from 1044 to 1046, who as Johannes Gratianus had earned a high reputation for learning and probity, succeeded Benedict IX., having bought off the antipopes Sylvester III. and John XX. In a council held by the emperor Henry III., at Sutri, in 1046, he was accused of simony, and his election was found to have been informal. This led to his degradation, and was followed by his withdrawal into Germany, where he died in the following year (1047). He was succeeded by Clement II.

GREGORY VII., ST., one of the greatest of the Roman pontiffs, was born about the year 1015 at Soano or Saona, a small town in Tuscany, where his father is said to have followed the trade of a carpenter. His own name, Hildebrand or Hellebrand, is suggestive of a German extraction; but of his remoter ancestry nothing is recorded. There is some reason to believe that, after passing his novitiate in Rome, Hildebrand removed for some years to Clugny; but all the earlier years of his life are involved in considerable obscurity. In 1046 he became one of the chaplains of the newly elected pope, Gregory VI., whom he shortly afterward accompanied into his German exile; and on the death of that pontiff, some two years later, he retired to Clugny, where his learning and sanctity made a deep impression, and where, according to some accounts, he was ultimately promoted to the office of prior. As a monk of Clugny he appears to have oftener than once visited the imperial court for the transaction of ecclesiastical business; and in 1049 he is said in a very special way to have come under the notice of Bruno, bishop of Toul, then on his way to Rome to take possession of the chair of St. Peter, which he occupied for some years under the title of Leo IX. It was at Hildebrand's instance that Bruno, who had been nominated by the emperor merely, consented to refrain from assuming the pontifical vestments, and to present himself to the Romans in the garb of a simple pilgrim, until he should have

been elected in a more regular manner. The ascendancy which Hildebrand had thus acquired over this pope he never afterward lost; in 1050 he became cardinal subdeacon, and in following years he was intrusted with various missions of great importance, taking also a prominent part in the important synods of Rheims and Mainz, as well as in those of Rome. On the death of Leo IX. in 1054 the Roman people had signified a desire that the subdeacon should succeed him; this honor and responsibility, however, Hildebrand declined; but he was one of three legates who went to Germany to consult with the emperor about the choice of a successor. The negotiations, which lasted eleven months, ultimately issued in the election of Gebhard of Eichstätt, a relative of the emperor, who up to that time had followed a distinctly antipapal policy, but who, immediately after his reception and consecration at Rome as Victor II. (April 13, 1055), became as entirely a tool in the hand of Hildebrand as Leo had been. It was during this pontificate that Hildebrand, as papal legate, attended the French synods held for the purpose of repressing the heresy of Berengarius. On the election of Pope Stephen IX. (X.), Hildebrand was again sent to Germany to defend the choice before the empress Agnes; in this mission, which was ultimately successful, several months were spent. Again, in 1058, he succeeded in defeating the hostile party of Benedict X. and in securing the tiara for Nicholas II.; and once more, in 1061, he successfully labored for the election of Alexander II. to the papal chair. At length, in 1073, on the death of Alexander, Hildebrand was himself compelled by the tumultuous demands of the mob to accept the vacant tiara (April 22d); but he refused to receive consecration until the sanction of the emperor had been obtained. This did not arrive for more than a month, although meanwhile he had been practically exercising many of the papal functions; finally, however, he was ordained to the priesthood, and some days afterward (June 30th), solemnly consecrated pope by the title of Gregory VII., a name which he chose in testimony of his veneration for the memory and character of his earliest patron, Gregory VI. Once firmly established on the papal throne, Gregory lost no time in giving the utmost possible practical effect to the two leading ideas of his life, the establishment of the supremacy of the papacy within the church and the effective assertion of the supremacy of the church over the state. In March, 1074, a synod was held in Rome which condemned the simony that had grown so prevalent throughout the church, and also enacted the old stringent laws of celibacy which had become almost a dead letter, especially in Germany and in the north of Italy; simoniacal or married priests were declared to be deposed and their priestly functions invalid. The resistance of the clergy to these decrees was utterly in vain; papal legates visited every country, and, supported by the popular voice, compelled submission. At a second synod held in Rome in February, 1075, the decrees of the first were confirmed, and the first blow was struck, which afterward resulted in the long protracted wars of investitures. The decree was aimed immediately at certain German bishops, Henry's personal advisers, but hardly less directly at Henry himself. The emperor, finding his hands at the moment fully occupied with the suppression of a revolt among the Saxons, was politic enough to conceal his resentment for the time, and to dismiss his advisers; but as soon as the war had been brought to a close, his defiance found ample expression. Meanwhile Gregory was not unopposed even in Italy, and during the Christmas festivities of 1075 a revolt in Rome itself was organized by Cencius, who had placed himself at the head of those

nobles who were opposed to reform; the pope, however, had the popular enthusiasm on his side, and ultimately the insurgents were compelled to fly. A papal embassy was next sent, early in 1076, to Henry at Goslar, citing him to appear personally at Rome at a council to be held in the second week of Lent, and there answer for his simony, sacrilege, and oppression. Henry's rage at this knew no bounds; he dismissed the legates with insult, and at the diet held at Worms (January 24, 1076,) replied by declaring Gregory deposed on charges of tyranny, magic and adultery, by sending notification of this fact to the Roman clergy, and by taking steps for appointing a successor to the dethroned pontiff. Gregory now lost no time in excommunicating all the bishops who had attended the diet of Worms, in solemnly deposing and excommunicating the emperor, and in absolving his subjects from their oath of allegiance (February 22, 1076). This counter action produced a powerful effect upon the German princes and people, many of whom had had good cause to resent Henry's tyrannies; one by one the bishops who had announced their withdrawal from Gregory's obedience now signified their contrition, and at a diet held at Tribur (September, 1076) the election of a new emperor began to be discussed. Resistance being in the meantime impossible, Henry resolved upon humbling himself to the utmost; in the dead of winter he set out to make his submission; Gregory was in waiting for him at Canossa, where (January 25 to 27, 1077) that famous penance which Europe has not yet forgotten was imposed. Absolved only on condition of his not assuming the royal dignity till his case had been investigated and decided, Henry had no sooner left the papal presence than he began to plot his revenge. Throwing himself upon the generosity of his Lombard vassals, he took courage to face the papal excommunication, which was renewed in November, 1078; and in the wars which ensued his arms were finally successful. Rudolf of Swabia having died soon after the battle of Merseburg, in 1080, the emperor proceeded with a powerful army to escort into Italy Guibert of Ravenna, who had been chosen at Brixen (June, 1080) as Gregory's successor. In three successive summers the attack on Rome was renewed, but it was not until 1084 (March 21st) that the treachery of some of the nobles of the city opened the gate to the invader. Gregory was now at last compelled to take refuge in the castle of St. Angelo, while Guibert was established on the pontifical throne as his successor, with the title of Clement III. After receiving coronation from Clement, Henry determined to return at once to Germany, especially as Robert Guiscard was known to be approaching. Released accordingly by the arrival of the Norman duke, Gregory excommunicated once more both Henry and Clement; but not deeming himself secure at Rome, where he had reason to know that his power was no longer what it once had been, he in May, 1084, placed himself under Robert's protection at Salerno, where he died May 25, 1085, after a comparatively brief pontificate of not much more than ten years. His last words are reported to have been, "I have loved righteousness and hated iniquity, and therefore I die in exile." His festival is observed throughout the Roman Church on the anniversary of his death. His successor was Victor III.

GREGORY VIII. (Albert de Mora), who was papal legate, had in 1172 attended the council of Avranches, which absolved Henry II. of England from the guilt of the murder of Thomas à Beckett, was consecrated pope in room of Urban III., October 25, 1187, and died of fever on December 17th of the same year. Clement III. was his successor.

GREGORY IX., pope from 1227 to 1241, the suc-

cessor of Honorius III., fully inherited the traditions of Gregory VII. and of his uncle Innocent III., and zealously gave himself up to the perpetuation of their policy. One of the first acts of his pontificate was to suspend the Emperor Frederick II., then lying sick at Otranto, for dilatoriness in carrying out his promised crusade; the suspension was followed by excommunication and threats of deposition after Frederick had written to the sovereigns of Europe complaining of his treatment. A consequent invasion of the patrimony of St. Peter at the instance of Frederick in 1228 having proved unsuccessful, the emperor was constrained to give in his submission and beg for absolution. Although peace was thus secured (August, 1230) for a season, the Roman people were far from satisfied; driven by a revolt from his own capital in July, 1232, the pope was compelled to take refuge at Anagni and invoke the aid of Frederick. A new outbreak of hostility led to a fresh excommunication of the emperor in 1239, and to a prolonged war which was only terminated by the death of Gregory (August 22, 1241). Gregory IX., was succeeded by Celestine IV.

GREGORY X., pope from 1271 to 1276, succeeded Clement IV. after the papal chair had been three years vacant; his election occurred while he was engaged in a pilgrimage to Saint Jean-d'Acre. On his arrival at Rome his first act was to summon the council which met at Lyons in 1274 for the purpose of considering the Eastern schism, the condition of the Holy Land, and the abuses of the Catholic Church. It was while returning from that council that he died at Arezzo on January 10, 1276. To him is due the bull which, subsequently incorporated into the code of canon law, continues to regulate all conclaves for papal elections. He was succeeded by Innocent V.

GREGORY XI. (Pierre Roger de Beaufort), pope from 1370 to 1378, born in Limousin in 1336, succeeded Urban V. in 1370 as one of the Avignon popes. During his pontificate vigorous measures were taken against the "heresies" which had broken out in Germany, England and other parts of Europe; a sincere effort was also made to bring about a reformation in the various monastic orders. His energy was largely stimulated by the stirring words of Catherine of Siena, to whom in particular the transference of the papal see back to Italy, January 27, 1377, was almost entirely due. He did not long survive this removal, dying on March 27, 1378. His successor was Urban VI., but the antipope Clement VII. also received much support, and the schism lasted forty years.

GREGORY XII. (Angelo Corario or Corrarò), pope from 1406 to 1409, born at Venice about 1326, succeeded Innocent VII. on November 30, 1406, having been chosen at Rome by a conclave consisting of only fifteen cardinals, under the express condition that, should Benedict XIII. of Avignon renounce all claim to the papacy, he also would renounce his, so that a fresh election might be made by the no longer divided church. Along with Benedict he was deposed by the council of Pisa in March, 1409, as schismatical, heretical, perjured and scandalous; but it was not till after the council of Constance had set aside John XXIII. (1415) that through his ambassador he formally renounced the title and dignity of lawful pope. The rest of his life was spent in peaceful obscurity as cardinal-bishop of Porto and legate of the mark of Ancona. He died October 18, 1417, having been succeeded in 1409 by Alexander V.

GREGORY XIII. (Ugo Buoncompagno), pope from 1572 to 1585, was born February 7, 1502, at Bologna, where he studied law and graduated in 1530, and afterward taught jurisprudence for some years,

Alexander Farnese and Charles Borromeo being among his pupils. At the age of thirty-six he was summoned to Rome by Paul III., under whom he held successive appointments as first judge of the capital, abbreviator, and vice-chancellor of the campagna; by Paul IV. he was attached as datarius to the suit of Cardinal Carafa; and by Pius IV. he was created cardinal priest and sent to the council of Trent. On the death of Pius V. in May, 1572, the choice of the conclave fell upon Buoncompagno, who assumed the name of Gregory XIII. His intervention in the affairs of Britain through Ireland and by means of his tool, Philip II., and also the league which he sought to cement against France (the massacre of the St. Bartholomew had taken place in September, 1572), are matters which belong to the histories of those countries. In order to raise funds for these and similar objects, he confiscated a large proportion of the houses and properties throughout the states of the church, — a measure which enriched his treasury, indeed, for a time, but by alienating the great body of the nobility and gentry, revived old factions, created new ones, and ultimately plunged his temporal dominions into a state bordering upon anarchy. Such was the position of matters at the time of his death, which took place April 10, 1585.

GREGORY XIV. (Niccolo Sfondrato), pope from 1590 to 1591; a native of Cremona, succeeded Urban VII., December 5, 1590. His brief pontificate was marked by no important occurrence, except that, instigated by the king of Spain and the duke of Mayenne, he excommunicated Henry IV. of France, declaring him, as a heretic and persecutor, to be deprived of his dominions, and also levied an army for the invasion of France. He was succeeded by Innocent IX.

GREGORY XV. (Alessandro Ludovisio), pope from 1621 to 1623, born at Bologna in 1554, succeeded Paul V. on February 9, 1621. Beyond assisting the German emperor against the Protestants, and the king of Poland against the Turks, he interfered little in European politics. He was a learned divine and manifested a reforming spirit; and his pontificate was marked by the canonization of St. Theresa, Francis Xavier, Ignatius Loyola, and Philip Neri. He died on July 18, 1623, and was succeeded by Urban VIII.

GREGORY XVI. (Bartolommeo Alberto Cappellari), pope from 1831 to 1846, was born at Belluno on September 18, 1765, and at an early age entered the order of the Camaldoli, among whom he rapidly gained distinction for his theological and linguistic acquirements. His first appearance before a wider public was in 1799, when he published against the Italian Jansenists a controversial work, which, besides passing through several editions in Italy, was translated into several European languages. In 1800 he became a member of the Academy of the Catholic Religion, founded by Pius VII. When Pius VII. was carried off from Rome in 1809, Cappellari withdrew to the monastery of San Michele at Murano, near Venice, and in 1814, with some other members of his order, he removed to Padua; but soon after the restoration of the pope he was recalled to Rome, where he received successive appointments as vicar-general of the Camaldoli, councilor of the Inquisition, prefect of the Propaganda, and examiner of bishops. In March, 1825, he was created cardinal by Leo XII., and shortly afterward was intrusted with an important mission to adjust a concordat regarding the interests of the Catholics of Belgium and the Protestants of Holland. On February 2, 1831, he was, after sixty-four days' conclave, unexpectedly chosen to succeed Pius VIII. in the papal chair. The revolution of 1830 had just inflicted a severe blow on the ecclesiastical party in France, and it

seemed as if similar disasters to the papal cause were imminent in other parts of Europe, when Gregory XVI. entered upon his fifteen years' pontificate. Almost the first act of the new Government of France was to unfurl the tricolor at Ancona; and the immediate effect was to throw all Italy, and particularly the Papal States, into a state of excitement such as seemed to call for strongly repressive measures. In the course of the struggle which ensued, the temporal reign of Gregory was marked accordingly by executions, banishments, imprisonments, to an extent which makes it impossible for the candid reader to absolve him from the charges of cruelty and bigotry which were so frequently raised at the time. The embarrassed financial condition in which he left the States of the Church also makes it doubtful how far his lavish expenditure in architectural and engineering works, and his magnificent patronage of learning in the hands of Mai, Mezzofanti, and others, were for the real benefit of his subjects. The years of his pontificate were marked by the steady development and diffusion of those ultramontane ideas which were ultimately formulated under the presidency of his successor Pius IX. by the council of the Vatican. He died June 1, 1846.

GREGORY, ST., THE ILLUMINATOR, the founder and patron saint of the Armenian Church, was born about 257 A.D. He belonged to the royal race of the Arsacides, being the son of a certain Prince Anak, who assassinated Chosroes of Armenia, and thus brought ruin on himself and his family. Educated by a Christian nobleman, Euthalius, in Cæsarea in Cappadocia, Gregory sought, when he came to man's estate, to introduce the Christian doctrine into his native land. At that time Tiridates I., a son of Chosroes, sat on the throne, and, influenced partly it may be by the fact that Gregory was the son of his father's enemy, he subjected him to much cruel usage, and imprisoned him for fourteen years. But vengeance and madness fell on the king, and at length Gregory was called forth from his pit to restore his royal persecutor to reason by virtue of his saintly intercession. The cause of Christianity was now secured; king and princes and people vied with each other in obedience to Gregory's instruction, and convents, churches and schools were established. Gregory in 302 received consecration as patriarch of Armenia from Leontius of Cæsarea and in 318 he appointed his son Aristax to be his successor. About 331 he withdrew to a cave in the mountain Sebu in the province of Daranalia in Upper Armenia, and there he died a few years afterward unattended and unobserved. When it was discovered that he was dead his corpse was removed to the village of Thordanum or Thortan. The remains of the saint were scattered far and near in the reign of Zeno. His head is said to be now in Italy, his right hand at Etchmiadzin, and his left at Sis.

GREGORY, ST., OF NAZIANZUS, surnamed THEOLOGUS, one of the four great fathers of the Eastern Church, was born about the year 329 A.D., at or near Nazianzus, Cappadocia. The events which were at that time stirring the political and ecclesiastical life of Cappadocia, and indeed of the whole Roman world, made a career of learned leisure difficult if not impossible to a man of Gregory's position and temperament. The emperor Constantius, having by a course of artful intrigue and intimidation succeeded in thrusting a semi-Arian formula upon the Western bishops assembled at Ariminum in Italy, had next attempted to follow the same course with the Eastern episcopate. The aged bishop of Nazianzus having yielded to the imperial threats, a great storm arose among the monks of the diocese, which was only quelled by the influence of the

younger Gregory, who shortly afterward (about 361) was ordained to the priesthood. After a vain attempt to evade his new duties and responsibilities by flight, he appears to have continued to act as a presbyter in his father's diocese without interruption for some considerable time; and it is probable that his two *invectives* against Julian are to be assigned to this period. Subsequently (about 372), under a pressure which he somewhat resented, he allowed himself to be nominated by Basil as bishop of Sasima. Toward 378-9 the small and depressed remnant of the orthodox party in Constantinople sent him an urgent summons to undertake the task of resuscitating the Catholic cause, so long persecuted and borne down by the Arians of the capital. The fame of Gregory as a learned and eloquent disciple of Origen, and still more of Athanasius, pointed him out as such a champion; nor could he resist the appeal made to him, although he took the step sorely against his will. Once arrived in Constantinople, he labored so zealously and well that the orthodox party speedily gathered strength; and the small apartment in which they had been accustomed to meet was soon exchanged for a vast and celebrated church which received the significant name of Anastasia, the Church of the Resurrection. He continued to labor in the Eastern capital till the arrival of Theodosius, and the visible triumph of the orthodox cause; the metropolitan see was then conferred upon him, and after the assembling of the second œcumenical council in 381 he received consecration from Meletius. The rest of his days were spent partly at Nazianzus, where he appears still to have mixed himself in ecclesiastical affairs, and partly on his patrimonial estate at Arianus, where he devoted himself to his favorite literary pursuits, and especially to poetical composition, until his death, which occurred in 389 or 390.

GREGORY, ST., OF NYSSA, one of the great Cappadocians, and designated by one of the later œcumenical councils as "a father of fathers," was a younger brother of St. Basil, and was born (probably) at Neocæsarea about 331 A.D. At a comparatively early age he entered the church, and held for some time the office of anagnost or reader; subsequently he manifested a desire to devote himself to the secular life as a rhetorician; but this impulse was checked by the earnest remonstrances of Gregory Nazianzen. Finally, in 371 or 372 he was ordained by his brother Basil to the bishopric of Nyssa, a small town in Cappadocia. His strict orthodoxy on the subject of the Trinity and the Incarnation, together with his vigorous eloquence, combined to make him peculiarly obnoxious to the Arian faction, which was at that time in the ascendant through the protection of the emperor Valens; and in 375, on the ground of the alleged irregularities in his election, and in the administration of the finances of his diocese, he was driven into exile, whence he did not return till the publication of the edict of Gratian in 378. Shortly afterward he took part in the proceedings of the synod which met at Antioch in Caria, principally in connection with the Meletian schism. At the great œcumenical council held at Constantinople in 381, he was a conspicuous champion of the orthodox faith; according to Nicephorus, indeed, the additions made to the Nicene creed were entirely due to his suggestion, but this statement is of doubtful authority. That his eloquence was highly appreciated is shown by the facts that he pronounced the discourse at the consecration of Gregory of Nazianzus, and that he was chosen to deliver the funeral oration on the death of Meletius the first president of the council. In the following year, moreover (382), he was commissioned by the council to inspect and set in order the churches of Arabia, in con-

nection with which mission he also visited Jerusalem. The exact date of his death is unknown; some authorities refer it to 396, others to 400.

GREGORY, ST., surnamed in later ecclesiastical tradition THAUMATURGUS (the miracle-worker), was born of noble and wealthy heathen parents at Neocæsarea, toward the beginning of the third century of the Christian era. His original name was Theodorus. Destined by his parents for the bar, he studied civil law at Athens, Alexandria, and Berytus. It is said; he afterward (about 231) accompanied his sister to Cæsarea in Palestine, where he became the pupil and finally the convert of Origen. In returning to Cappadocia, some five years after his conversion, it had been his original intention to live a retired ascetic life, but this wish he was not permitted to gratify. Urged by Origen, and at last almost compelled by Phædimus of Amasia, his metropolitan, neither of whom was willing to see so much learning, piety, and masculine energy practically lost to the church, he, after many attempts to evade the dignity, was consecrated bishop of his native town (about 240). His episcopate, which lasted some thirty years, was characterized by great zeal, and by so much success that, according to the (doubtless somewhat rhetorical) statement of Gregory of Nyssa, whereas at the outset of his labors there were only seventeen Christians in the city, there were at his death only seventeen persons in all who had not embraced Christianity. Gregory is believed to have died in the reign of Aurelian, about the year 270, though some accounts place his death six years earlier.

GREGORY, ST. OF TOURS (c. 540-594), historian of the Franks, was born at Clermont, Auvergne, not earlier than 539 and not later than 543 A.D. He was the youngest son of Florentius, a provincial senator, and head of one of the oldest and most powerful Christian families in the country; at his baptism he received the name of George, that of Gregory not having been assumed until his consecration, at least thirty years afterward. Having been ordained a deacon on attaining the canonical age, the youthful Georgius Florentius for a time attended in some ecclesiastical capacity the court of Sigebert of Austrasia; and when in 573 a vacancy occurred in the see of Tours, which had been occupied by many of his kindred, his reputation for piety and wisdom led to his being immediately designated as a suitable successor to that bishopric. In 581 he took a leading part in adjusting that arrangement between Chilperic and Childebert which gave peace to France for many years. He died at Tours on November 17, 594, and subsequently attained the honors of beatification and canonization, his day in the calendar being November 17th.

GREGORY, the name of a Scottish family, many members of which attained high eminence in various departments of science, sixteen having held professorships. Of the most distinguished of their number a notice is given below.

DAVID GREGORY (1628-1720), eldest son of the Rev. John Gregory of Drumoak, Aberdeenshire, was born in 1628. For some time he was connected with a mercantile house in Holland, but on succeeding to the family estate of Kinardie he returned to Scotland, and occupied most of his time in scientific pursuits, freely giving his poorer neighbors the benefit of his medical skill. He is said to have been the first possessor of a barometer in the north of Scotland; and on account of his success by means of it in predicting changes in the weather, he was accused of witchcraft before the presbytery of Aberdeen, but he succeeded in convincing that body of his innocence. He died in 1720.

JAMES GREGORY (1638-1675), the author of important discoveries in mathematics and optics, younger

brother of the preceding, was born in 1638. At an early period he manifested a strong inclination and capacity for mathematics and kindred sciences; and before completing his twenty-third year he published his famous treatise *Optica Promota*, in which he made known his great invention the Gregorian reflecting telescope. About 1665 he went to the university of Padua, where he studied for some years, and in 1667 published *Vera Circuli et Hyperbolæ Quadratura*, in which he propounded his method of an infinitely converging series for the areas of the circle and hyperbola. On his return to England in this year he was elected a member of the Royal Society; in the following year he became professor of mathematics in the university of St. Andrews; and in 1674 he was transferred to the chair of mathematics in Edinburgh. In October, 1675, while showing the satellites of the planet Jupiter to some of his students through one of his telescopes, he was suddenly struck with blindness; and he died a few days afterward at the early age of thirty-seven.

DAVID GREGORY (1661-1708), nephew of the preceding and son of the David Gregory above mentioned, was born in Aberdeen in 1661. He was educated partly in his native city and partly in Edinburgh, where at the age of twenty-three he became professor of mathematics. In 1691 he was appointed Savilian professor of astronomy at Oxford, an office which he held till his death in 1708. He was succeeded in the chair of mathematics in Edinburgh by his brother James; another brother, Charles, was in 1707 appointed professor of mathematics in the university of St. Andrew's; and his eldest son, David, became professor of modern history at Oxford, and canon and latterly dean of Christ Church.

JOHN GREGORY (1724-1773), professor of medicine in the university of Edinburgh, grandson of James Gregory, the inventor of the Gregorian telescope, and youngest son of Dr. James Gregory, professor of medicine in King's College, Aberdeen, was born at Aberdeen, June 3, 1724. After studying at the grammar school of Aberdeen, and completing his literary course at King's College in that city, he attended the medical classes at Edinburgh university. In 1745 he went to Leyden to complete his medical studies, and during his stay there he received without solicitation the degree of doctor of medicine from King's College, Aberdeen. On his return from Holland he was elected professor of philosophy at King's College, but in 1749 he resigned his professorship on account of its duties interfering too much with his practice as a physician. In 1754 he proceeded to London, in 1764 removed to Edinburgh, and died in 1773.

JAMES GREGORY (1753-1821), professor of the practice of medicine in the university of Edinburgh, eldest son of the preceding, was born at Aberdeen in 1753, accompanied his father to Edinburgh in 1764, and after going through the usual course of literary studies at that university, was for a short time a student at Christ Church, Oxford. He entered on the study of medicine at Edinburgh, and, after graduating doctor of medicine in 1774, spent the greater part of the next two years in Holland, France and Italy. Shortly after his return to Scotland he was appointed in 1776 to the chair his father had formerly held, and in the following year he also entered on the duties of teacher of clinical medicine in the Royal Infirmary. On the illness of Doctor Cullen in 1790, he was appointed joint professor of the practice of medicine; he became sole professor on the death of Doctor Cullen in the same year; and he continued to deliver lectures on that subject to audiences almost regularly increasing, until his last illness in 1821. He died on April 2d of that year.

WILLIAM GREGORY (1803-1858), son of the preceding, was born December 25, 1803. In 1837 he became professor of chemistry at the Andersonian Institution, Glasgow, in 1839 at King's College, Aberdeen, and in 1844 at Edinburgh University. He died April 24, 1858.

DUNCAN FARQUHARSON GREGORY (1813-1844), brother of the preceding, was born April 13, 1813. After studying at the university of Edinburgh he in 1833 entered Trinity College, Cambridge, where he was for a time assistant professor of chemistry, and was one of the founders of the chemical society. He latterly devoted his chief attention to mathematics, in which he made some important discoveries. He died February 23, 1844.

GREGORY, OLINTHUS, LL.D. (1774-1841), was born January 29, 1774, at Yaxley, Huntingdonshire. He was only nineteen when he published *Lessons Astronomical and Philosophical* (1793), and soon after by a manuscript on the *Use of the Sliding Rule*, he was fortunate enough to excite the interest of Doctor Hutton, professor of mathematics at the Royal Military Academy of Woolwich. Having settled at Cambridge in 1798, Gregory first acted as subeditor of a provincial newspaper, and then opened a bookseller's shop; but before long he found that he would be better off as a private teacher of mathematics. In 1802 he obtained an appointment as mathematical master at Woolwich through the influence of Hutton; and when Hutton resigned in 1807, Gregory succeeded him in the professorship. Failing health obliged him to retire in 1838, and he died at Woolwich February 2, 1841.

GREIFENBERG, the chief town of a circle in the Prussian province of Pomerania and government of Stettin, is situated on the Rega, forty-five miles north-east of Stettin. Population (1890), 6,000.

GREIFENHAGEN, the chief town of a circle in the Prussian province of Pomerania and government of Stettin, is situated on the Reglitz, twelve miles south-southwest of Stettin. Population (1890), 7,000.

GREIFSWALD, or **GREIFSWALDE**, the chief town of a circle in the Prussian province of Pomerania and government of Stralsund, is situated on the Ryck, three miles from its mouth in the Baltic, and twenty miles south-by-east of Stralsund. Population (1890), 20,000.

GREIZ, or **GREITZ**, a town of Germany, capital of the principality of Reuss-Greiz, is situated in a pleasant valley on the right bank of the White Elster, near the borders of Saxony, and fourteen miles west-by-south of Zwickau. Population (1890), 14,000.

GRENADA, the most southern island of the Antilles. It is thirty leagues southwest of Barbados, and about sixty miles from the nearest point of South America. Its length from north to south is about twenty-four miles, and its greatest breadth is twelve miles. The area is 133 square miles. Population (1890), about 45,000.

The soil is extraordinarily fertile; but cotton, indigo, and tobacco are not now cultivated. Fruits and some kinds of European vegetables grow luxuriantly. Sugar cultivation is not extending, but cocoa is now making rapid strides. The island is divided into six parishes. Formerly it had a house of assembly, but is now an English crown colony under the general government of the Windward Islands. It has a lieutenant-governor and a council consisting of officials and members nominated by the crown.

The capital, St. George's (population, about 5,000), is built upon a peninsula projecting into a spacious bay on the west side of the island, near the southern extremity. The houses are of brick or stone, and stand on high ground which rises from the bay.

GRENOBLE, a fortified city of France, formerly the chief town of Dauphiné and now of the department of the Isère. With the exception of its more modern portions, the town of Grenoble is characterized by the tortuous and crowded streets usual in places that have long been confined within strong fortifications. The cathedral of Notre Dame, a vast brick building of various periods from the tenth to the seventeenth century, the foundation of which is traditionally ascribed to Charles the Great; the church of St. Laurence, with a remarkable crypt of the eleventh century, long believed to be an old temple of Æsculapius; and the church of St. André, founded by the dauphin Guigues André about 1220, and frequently visited for the sake of the tomb of Bayard removed thither in 1822, are the most noteworthy of the ecclesiastical edifices. The palais de justice is a striking erection of the fifteenth and sixteenth centuries occupying the site of the old castle of the dauphins, and in front is a statue of Bayard dating from 1823. Population, about 50,000.

GRENVILLE, GEORGE, an English statesman, second son of Richard Grenville and Hester Temple, afterward Countess Temple, was born October 14, 1712. He was educated at Eton and at Christ Church, Oxford, and in his twenty-fifth year was called to the bar. He entered parliament in 1741 as member for Buckingham, and continued to represent that borough till his death in 1770. In December, 1744, he became a lord of the admiralty, in June, 1747, a lord of the treasury, and in 1754, treasurer of the navy and privy councilor. He remained in office in 1761, when his brother, Lord Temple and his brother-in-law Pitt resigned upon the question of the war with Spain, and in the administration of Lord Bute he was intrusted with the leadership of the House of Commons. In May, 1762, he was appointed secretary of state, and in October, first lord of the admiralty; and in April, 1763, he became first lord of the treasury and chancellor of the exchequer. The most prominent measures of his administration were the prosecution of Wilkes and the passing of the American Stamp Act, which led to the first symptoms of alienation between America and the mother country. During the latter period of his term of office he was on a very unsatisfactory footing with the young king George III., who gradually came to feel a kind of horror of the interminable persistency of his conversation, and whom he endeavored to make use of as the mere puppet of the ministry. The king made various attempts to induce Pitt to come to his rescue by forming a ministry, but without success, and at last had recourse to the marquis of Rockingham, on whose agreeing to accept office Grenville was dismissed July, 1765. He never again held office, and died November 13, 1770.

GRENVILLE, WILLIAM WYNDHAM GRENVILLE, LORD, English statesman, son of the preceding, was born October 25, 1759. In February, 1782, he was elected a member of parliament for the county of Buckingham, and in the September following he became secretary to his brother the marquis of Buckingham, who had been named lord-lieutenant of Ireland. On the overthrow of the cabinet of Lord Shelburne in the following year he returned to England, and in December he was appointed, by his cousin, Pitt, paymaster-general of the forces. In 1789 he was chosen speaker of the house of commons, but he vacated the chair in the same year, and was transferred to the upper house with the title of Lord Grenville, on being appointed secretary of state. He exchanged this office in 1791 for that of secretary of foreign affairs, being regarded by Pitt as the person best fitted to carry out his policy in reference to France. Along with Pitt he resigned office in 1801, on account of the king declining to grant any

concessions to the Catholics; and when Pitt, on accepting office in 1804, did not stipulate for Catholic emancipation, he declined to join his ministry, and entered into a close alliance with Fox. On the death of Pitt in 1806 he became the nominal head of the government of "All the Talents," whose military projects resulted very unsuccessfully, but which deserves to be remembered with honor on account of the act for the abolition of the slave trade. In 1819, when the marquis of Landsdowne brought forward his motion for an inquiry into the cause of distress and discontent in the manufacturing districts, Grenville delivered an alarmist speech, in which he advocated the adoption of severely repressive measures. He died January 12, 1834.

GRESHAM, SIR THOMAS, a London merchant, the founder of the Royal Exchange and of Gresham College, London, was born in 1519.

Under Queen Elizabeth, besides continuing to act as financial agent of the crown, he was for some time ambassador at the court of the duchess of Parma. In 1559 he received the honor of knighthood. By the outbreak of the war in the Low Countries he was compelled to leave Antwerp on March 19, 1567; but, though he spent the remainder of his life in London, he continued his business as merchant and financial agent of the government in much the same way as formerly. In 1565 Gresham made a proposal to the court of aldermen of London to build, at his own expense, a bourse or exchange, on condition that they purchased for this purpose a piece of suitable ground. In this proposal he seems to have had an eye to his own interest as well as to the general good of the merchants, for by a yearly rental of £700, obtained for the shops in the upper part of the building, he received a sufficient return for his trouble and expense. Gresham died suddenly, apparently of apoplexy, November 21, 1579.

GRESSET, JEAN BAPTISTE (1709-1777). The literary history of Gresset might be dismissed with the simple statement that he wrote *Vert Vert*. By that one poem he is remembered. His life is, however, interesting from another fact, that he, who almost alone among French poets wrote nothing of which a moralist need be ashamed, spent the last twenty-five years of his life in regretting the frivolity which enabled him to produce the most charming of poems. He published *Vert Vert* at Rouen, being then twenty-four years of age. It is a story, in itself exceedingly humorous, showing how a parrot, the delight of a convent, whose talk was all of prayers and pious ejaculations, was conveyed to another convent as a visitor to please the nuns. On the way he falls among bad companions, forgets his convent language, and shocks the sisters on arrival by profane swearing. He is sent back in disgrace, punished by solitude and plain bread, presently repents, reforms, and is killed by kindness. The story, however, is nothing. The treatment of the subject, the atmosphere which surrounds it, the delicacy in which the little prattling ways of the nuns, their jealousies, their tiny trifles, are presented, takes the reader entirely by surprise. The poem stands absolutely unrivaled, even among French *contes en vers*.

GRÉTRY, ANDRÉ ERNEST MODESTE, a celebrated composer of French opera, was born at Liège, February 11, 1741. He received his first musical education in the *maîtrise* of the college of St. Denis, where his father, a poor musician, occasionally acted as violinist. His first great success was achieved by an Italian intermezzo or operetta, *Le vendemiatrici*, composed for the Aliberti theater in Rome, and received with universal applause. It is said that the study of the score of one of Monsigny's operas, lent to him by a secretary of the French embassy in Rome, decided Grétry to devote himself to

French comic opera. On New Year's Day, 1767, he accordingly left Rome, and after a short stay at Geneva (where he made the acquaintance of Voltaire, and produced another operetta) went to Paris. There for two years he had to contend with the difficulties incident to poverty and obscurity. He was, however, not without friends, and by the intercession of one of these, Count Creutz, the Swedish ambassador, Grétry obtained a libretto from the celebrated Marmontel, which he set to music in less than six weeks, and which, on its performance in August, 1768, met with unparalleled success. The name of the opera was *Le Huron*. Two others, *Lucile* and *Le Tableau Parlant*, soon followed, and thenceforth Grétry's position as the leading composer of comic opera was safely established. Grétry died September 24, 1813, at the Hermitage in Montmorency, formerly the house of Rousseau.

GREUZE, JEAN BAPTISTE, in the full tide of the eighteenth century, when professional distinction appeared to be reserved exclusively for those who devoted themselves to the production of historical or allegorical subjects, achieved an immense reputation as a painter of scenes of domestic life. He was born at Tournus in 1725, and is generally said to have formed his own talent; this is, however, true only in the most limited sense, for at an early age his inclinations, though thwarted by his father, were encouraged by a Lyonnese artist named Grandon or Grondom who enjoyed during his lifetime considerable reputation as a portrait-painter. In 1755 Greuze exhibited his *Aveugle Trompé*. Toward the close of the same year he left France for Italy. In 1759, 1761 (*L'Accordée de Village*, — Louvre), and 1763 Greuze exhibited with ever increasing success; in 1765 he reached the zenith of his powers and reputation. In that year he was represented with no less than thirteen works. The Academy took occasion to press Greuze for his diploma picture, the execution of which had been long delayed, and forbade him to exhibit on their walls until he had complied with their regulations. Greuze wished to be received as an historical painter, and produced a work which he intended to vindicate his right to despise his qualifications as a *peintre de genre*. This unfortunate canvas, — *Sevère et Caracalla* (Louvre), — was exhibited in 1769 side by side with Greuze's portrait of Jaurat (Louvre), and his admirable *Petite Fille au Chien Noir*. The Academicians received their new member with all due honors, but at the close of the ceremonies the Director addressed Greuze in these words — "Monsieur, l'Académie vous a reçu, mais c'est comme peintre de genre; elle a eu égard à vos anciennes productions, qui sont excellentes, et elle a fermé les yeux sur celle-ci, qui n'est digne ni d'elle ni de vous." (Sir, the Academy receives you, but only as a *genre* painter; she having regard for your former productions, which are excellent, and although your eyes are fixed above her, which is creditable neither to her nor in you.) Greuze, greatly incensed, quarreled with his *confrères*, and ceased to exhibit until, in 1804, the Revolution had thrown open the doors of the Academy to all the world. In the following year, on March 4, 1805, he died in the Louvre in great poverty.

GREVILLE, CHARLES CAVENDISH FULKE, was born April 2, 1794. He was one of the pages of George III., and was educated at Eton and Christ Church, Oxford; but he left the university early, having been appointed private secretary to Earl Bathurst before he was twenty. The interest of the duke of Portland had secured for him the secretaryship of the island of Jamaica, which was a sinecure office, the duties being performed by a deputy, and the reversion of the clerkship of the council. Greville entered upon the discharge of the

duties of clerk of the council in ordinary in 1821, and continued to perform them for nearly forty years. He therefore served under three successive sovereigns—George IV., William IV., and Victoria—and although no political or confidential functions are attached to that office, it is one which brings a man into habitual intercourse with the chiefs of all the parties in the state. Well-born, well-bred, handsome, and accomplished, Greville led the easy life of a man of fashion, taking an occasional part in the transactions of his day and much consulted in the affairs of private life. But the celebrity which now attaches to his name is entirely due to the posthumous publication of a portion of a journal or diary which it was his practice to keep during the greater part of his life. These papers were given by him to his friend Mr. Reeve a short time before his death (which took place January 18, 1865), with an injunction that they should be published, as far as was feasible, at not too remote a period after the writer's death. The journals of the reigns of George IV. and William IV. (extending from 1820 to 1837) were accordingly so published in obedience to his directions about ten years after that event. Few publications have been received with greater interest by the public; five large editions were sold in a little more than a year, and the demand in America was as great as in England. These journals were regarded as a faithful record of the impressions made on the mind of a competent observer, at the time, by the events he witnessed and the persons with whom he associated. Their characteristic is the love of truth, of justice, and of sincerity. The court was irritated at the scornful disclosure of the vices and follies of former sovereigns, and fashionable society was annoyed at the writer's absolute indifference to its pretensions. But Greville did not stoop to collect or record private scandal. His object appears to have been to leave behind him some of the materials of history, by which the men and actions of his own time would be judged. He records not so much public events as the private causes which led to them; and perhaps no English memoir-writer has left behind him a more valuable contribution to the history of this century.

GREW, NEHEMIAH (1628–1711), the earliest anatomist and physiologist of England, was the son of Obadiah Grew, nonconformist divine of St. Michael's, Coventry. At the Restoration, his father being ejected from his living, he went to a foreign university, where he took the degree of doctor of physic. Returning to Coventry, his native town, he commenced a series of observations on the physiology of plants, communicating the results to the Royal Society; by which they were so well received that he was induced to remove to London (1672). There he acquired an extensive practice as a physician. He was elected a fellow of the Royal Society on the recommendation of Bishop Wilkins, and in 1677 he succeeded Mr. Oldenburg as secretary, in which capacity he prepared a descriptive catalogue of the rarities preserved at Gresham College (1681). The following year appeared his celebrated work on the *Anatomy of Plants*, in which he displayed great originality as an investigator, especially in pointing out the sex-differences of plants.

GREY, EARL. Charles, second Earl Grey, was the eldest surviving son of General Sir Charles Grey, afterward first Earl Grey. He was born at his father's residence, Fallodon, near Alnwick, March 13, 1764. He was sent to Eton, and thence to Cambridge. Pitt's elevation to the premiership, his brilliant and hard-fought battle in the house, and his complete rout of the Whig party at the general election of 1784, when he came in for Cambridge at the head of the poll, threatened the great territorial interest with nothing less than

extinction. It was to this interest that Grey belonged; and hence, when at length returned for Northumberland in 1786, he at once came forward as a vigorous assailant of the Government of Pitt. He was hailed by the opposition, and associated with Fox, Burke, and Sheridan as a manager in the Hastings impeachment. During the nineteen years which remained of the career of Fox, he followed the great Whig statesman with absolute fidelity, and succeeded him as leader of the party.

When Pitt died in 1806, nothing could prevent the reunited opposition from coming into power, and thus the Broad-bottom ministry was formed under Fox. On his death, Grenville became premier, and Grey, now Lord Howick, Foreign Secretary, and leader of the House of Commons. Disunion, always the bane of English Liberalism, lurked in the coalition, and the Foxites and Grenvillites were only ostensibly at one. When they proposed to concede a portion of the Catholic claims, King George refused, and demanded of them an undertaking never to propose such a measure again. This was refused, and the Grenville-Grey cabinet retired in March, 1807. In the same year Grey's father died, and Grey went to the Upper House. Opposition united Grey and Grenville for a time, but the parties finally split on the old war question. We now reach the principal episode in Grey's career. In 1827 he seem to stand forth the solitary and powerless relic of an extinct party. In 1832 we find that party restored to its old numbers and activity, supreme in parliament, popular in the nation, and Lord Grey at its head. The duke of Wellington's foolish declaration against parliamentary reform, made in a season of great popular excitement, suddenly deprived him of the confidence of the country, and a coalition of the Whigs and Canningites became inevitable. The Whigs had in 1827 supported the Canningites; the latter now supported the Whigs, of whom Grey remained the traditional head. George IV. was dead, and no obstacle existed to Grey's elevation. Grey was sent for by William IV. in November, 1830, and formed a coalition cabinet, pledged to carry on the work in which the duke of Wellington had faltered. But Grey himself was the mere instrument of the times. An old-fashioned Whig, he had little personal sympathy with the popular cause, though he had sometimes indicated a certain measure of reform as necessary. When he took office, he guessed neither the extent to which the Reform Act would go, nor the means by which it would be carried.

The second reading of the first reform bill was carried in the Commons by a majority of one. This was equivalent to a defeat, and further failures precipitated a dissolution. The confidence which the bold action of the ministry had won was soon plainly proved, for the second reading was carried in the new parliament by a majority of 136. When the bill had at length passed the Commons after months of debate, it was Grey's task to introduce it to the Lords. It was rejected by a majority of forty-one. The safety of the country now depended on the prudence and courage of the ministry. The resignation of Grey and his colleagues was dreaded even by the opposition, and they remained in office with the intention of introducing a third reform bill in the next session. The last months of 1831 were the beginning of a political crisis such as England had not seen since 1688. The two extreme parties, the Ultra-Radicals and the Ultra-Tories, were ready for civil war. Between them stood the ministry and the majority of intelligent peace-loving Englishmen; and their course of action was soon decided. The bill must be passed, and there were but two ways of passing it.

One was to declare the consent of the House of Lords unnecessary to the measure, the other to create, if necessary, new peers in sufficient number to outvote the opposition. These two expedients did not in reality differ. To swamp the house in the way proposed would have been to destroy it. The question whether the ministry should demand the king's consent to such a creation, if necessary, was debated in the cabinet in September. Brougham proposed it, and gradually a majority of the cabinet were won over. Grey had at first refused to employ even the threat of so unconstitutional a device as a means to the proposed end. But his continued refusal would have broken up the ministry, and the breaking up of the ministry must now have been the signal for revolution. The second reading in the Commons was passed in December by a majority of 162, and on New Year's Day, 1832, the majority of the cabinet resolved on demanding power to carry it in the lords by a creation of peers. It was not until April 9th that Grey moved the second reading in the Lords. A sufficient number of the opposition temporized; and the second reading was allowed to pass by a majority of nine. Their intention was to mutilate the bill in committee. The Ultra-Tories, headed by the duke of Wellington, had entered a protest against the second reading, but they were now politically powerless. The struggle had become a struggle on the one hand for the whole bill, to be carried by a creation of peers, and on the other for some mutilated measure. The king, a weak and inexperienced politician, had in the meantime been wrought upon by the temporizing leaders in the Lords. He was induced to believe that if the Commons should reject the mutilated bill when it was returned to them, and the ministry should consequently retire, the mutilated bill might be reintroduced and passed by a Tory ministry. He was deaf to all representations of the state of public opinion; and to the surprise of the ministry, and the terror and indignation of every man of sense in the country, he rejected their proposal, and accepted their resignation, May 9, 1832. The duke of Wellington undertook the hopeless task of constructing a ministry which should pass a restricted or sham reform bill, and after a week of the profoundest agitation throughout the country, the king, beaten and mortified, was forced to send for Grey and Brougham. On being told that his consent to the creation of peers was the only condition on which they could undertake the government, he angrily and reluctantly yielded. The chancellor, with cool forethought, demanded this consent in writing. Grey thought such a demand harsh and unnecessary. "I wonder," he said to Brougham, when the interview was over, "you could have had the heart to press it." But Brougham was inexorable, and the king signed the following paper: "The king grants permission to Earl Grey, and to his chancellor, Lord Brougham, to create such a number of peers as will be sufficient to ensure the passing of the Reform Bill, first calling up peers' eldest sons.—WILLIAM R., Windsor, May 17, 1832." This brief paper may be called the Magna Charta of responsible government. It established the right of a ministry to break down, by some convenient means, a factious opposition in the Lords; and this right has never since been practically disputed.

It is well known that in after years both Grey and Brougham disclaimed any intention of executing their threat. Grey took but little part in directing the legislation of the reformed parliament. Lord Althorp resigned, and Grey, who had lately passed his seventieth year, took the opportunity of resigning also. Grey was succeeded by Lord Melbourne; but no other change was made in the cabinet. Grey took no further part in politics. During most of his remaining years he con-

tinued to live in retirement at Howick, where he died on July 17, 1845, in his eighty-second year.

GREY, LADY JANE, a person remarkable no less for her accomplishments than for her misfortunes, was the great-granddaughter of Henry VII. of England. Her descent from that king was traced through a line of females. His second daughter, Mary, after being left a widow by Louis XII. of France, married Charles Brandon, duke of Suffolk, who was a favorite with her brother King Henry VIII. Of this marriage came two daughters, the elder of whom, Lady Frances Brandon, was married to Henry Grey, marquis of Dorset; and their issue, again, consisted of daughters only. Lady Jane, the subject of this article, was the eldest of three whom the marquis had by Lady Frances. Thus it will appear that even if the crown of England had ever fallen into the female line of descent from Henry VII., she could not have put in a rightful claim unless the issue of his elder daughter, Margaret, had become extinct. But Margaret had married James IV. of Scotland; and, though her descendant, James VI., was ultimately called to the English throne, Henry VIII. had placed her family after that of his second sister in the succession; so that, failing the lawful issue of Henry himself, Lady Jane would, according to this arrangement, have succeeded. It was to these circumstances that she owed her exceptional position in history, and became the victim of an ambition which was not her own.

She was born in Leicestershire, about the year 1537. Her parents bestowed more than ordinary care upon her education, and she herself was so teachable, and delighted so much in study, that she became the marvel of the age for her acquirements. She not only excelled in needlework and in music, both vocal and instrumental, but while still very young she had thoroughly mastered Latin, Greek, French and Italian. She had also acquired some knowledge of at least three Oriental tongues, Hebrew, Chaldee and Arabic. After the fashion of those days she was, when about ten years old, placed for a time in the household of Thomas, Lord Seymour, who induced her parents to let her stay with him by promising to marry her to his nephew, King Edward VII. Lord Seymour, however, was attainted of high treason, and beheaded in 1549, and his brother, the duke of Somerset, made some overtures to the marquis of Dorset to marry her to his son, the earl of Hertford. These projects, however, came to nothing. The duke of Somerset in his turn fell a victim to the ambition of Dudley, duke of Northumberland, and was beheaded three years after his brother. Meanwhile, the dukedom of Suffolk having become extinct by the deaths of Charles Brandon and his two sons, the title was conferred upon the marquis of Dorset, Lady Jane's father. Northumberland, who was now all-powerful, fearing a great reverse of fortune in case of the king's death, whose health soon began visibly to decline, endeavored to strengthen himself by marriages between his family and those of other powerful noblemen, especially of the new-made duke of Suffolk. His three eldest sons being already married, the fourth, who was named Lord Guildford Dudley, was accordingly wedded to Lady Jane Grey about the end of May, 1553. The match received the full approval of the king, who furnished the wedding apparel of the parties by royal warrant. But Edward's state of health warned Northumberland that he must lose no time in putting the rest of his project into execution. He persuaded the king that if the crown should descend to his sister Mary, the work of the Reformation would be undone and the liberties of the kingdom would be in danger. Besides, both Mary and her sister Elizabeth had been declared illegitimate

by separate acts of parliament, and the objections to Mary Queen of Scots did not require to be pointed out. Edward was easily persuaded to break through his father's will and make a new settlement of the crown by deed. The document was witnessed by the signatures of all the council, and of all but one of the judges; but those of the latter body were not obtained without difficulty by threats and intimidation.

Edward VI. died on July 6, 1553, and it was announced to Lady Jane that she was queen. She was then but sixteen years of age. The news came upon her as a most unwelcome surprise, and for some days she resisted all persuasions to accept the fatal dignity; but at length she yielded to the entreaties of her father, her father-in-law, and her husband. The better to mature their plans the cabal had kept the king's death secret for some days, but they proclaimed Queen Jane in London on the 10th. The people received the announcement with manifest coldness, and a vintner's boy was even so bold as to raise a cry for Queen Mary, for which he next day had his ears nailed to the pillory and afterward cut off. Mary, however, had received early intimation of her brother's death, and, retiring from Hunsdon into Norfolk, gathered around her the nobility and commons of those parts. Northumberland was dispatched thither with an army to oppose her; but after reaching Newmarket he complained that the council had not sent him forces in sufficient numbers, and his followers began to desert. News also came that the Earl of Oxford had declared for Queen Mary; and as most of the council themselves were only seeking an opportunity to wash their hands of rebellion, they procured a meeting at Baynard's Castle, revoked their former acts as done under coercion, and caused the lord mayor to proclaim Queen Mary, which he did amid the shouts of the citizens. The Duke of Suffolk was obliged to tell his daughter that she must lay aside her royal dignity and become a private person once more. She replied that she relinquished most willingly a crown that she had only accepted out of obedience to him and her mother; and her ten days' reign was over.

The leading actors in the conspiracy were now called to answer for their deeds. Northumberland was brought up to London a prisoner, tried and sent to the block, along with some of his partisans. The Duke of Suffolk and Lady Jane were also committed to the Tower; but the former, by the influence of his duchess, procured a pardon. Lady Jane and her husband, Lord Guildford Dudley, were also tried, and received sentence of death for treason. This, however, was not immediately carried out; on the contrary the queen seems to have wished to spare their lives, and mitigated the rigor of their confinement. Unfortunately, owing to the general dislike of the queen's marriage with Philip of Spain, Sir Thomas Wyatt soon after raised a rebellion in which the Duke of Suffolk and his brothers took part, and on its suppression the queen was persuaded that it was unsafe to spare the lives of Lady Jane and her husband any longer. On hearing that they were to die, Lady Jane declined a parting interview with her husband lest it should increase their pain, and prepared to meet her fate with Christian fortitude. She and her husband were executed on the same day, February 12, 1554, her husband on Tower Hill, and herself within the Tower an hour afterward, amidst universal sympathy and compassion.

GREYHOUND. See DOG.

GREYTOWN, or more correctly San Juan del Norte, a small town of Nicaragua, worthy of note as the only port of the republic on the coast of the Atlantic and as the eastern terminus proposed for the Nicaraguan inter-oceanic canal. The town lies along the seaward side of a

narrow peninsula formed by the windings of the San Juan river, and most of its buildings are insignificant erections raised two or three feet on piles. Though it is still a port of call for mail steamers, and monopolizes the export and import trade of Nicaragua, Greytown is in a decadent condition. Its fine harbor has become almost useless. The harbor of San Juan, first discovered by Columbus, was brought into further notice by Capt. Diego Machuca, who in 1529 sailed down the river from the Lake of Nicaragua. The date of the first Spanish settlement on the spot is not known, but in the seventeenth century there were fortifications at the mouth of the river. In 1796 San Juan was made a port of entry by royal charter, and new defenses were erected in 1821. The patriots of Nicaragua seized the place at the revolution, but they were expelled in January, 1848, by the British, who, claiming the district in the name of the "king of the Mosquito Indians," continued in possession till the treaty of 1860. In 1854 the town was bombarded by the United States forces for an alleged insult.

GRIBOYEDOFF, ALEXANDER SERGUEEVICH, was born in 1795 at Moscow, where he studied at the university from 1810 to 1812. He then obtained a commission in a hussar regiment, but resigned it in 1816. Next year he entered the civil service, and in 1818 was appointed secretary of the Russian legation in Persia, whence he was transferred to Georgia. There he began the drama which has made him famous. He had commenced writing early, and had produced on the stage at St. Petersburg in 1819 a comedy in verse, translated from the French, called *The Young Spouses*, which was followed by some other pieces of the same kind. But neither these, nor the essays and verses, which he wrote for periodicals, would have been long remembered but for the immense success gained by his comedy in verse, *Goré ot uma*, or "Misfortune from Intelligence." Griboyedoff spent the summer of 1823 in Russia, completed his play, and took it to St. Petersburg. There it was rejected by the censorship. Many copies were made and privately circulated, but Griboyedoff never saw it published. The first edition was printed in 1833, four years after his death. He was sent to Persia as a minister-plenipotentiary. Soon after his arrival at Teheran a tumult arose, caused by the anger of the populace against some Georgian and Armenian captives, — Russian subjects, — who had taken refuge in the Russian embassy. It was stormed, Griboyedoff was killed (February 11, 1829), and his body was for three days so ill-treated by the mob that it was at last recognized only by an old scar on the hand, due to a wound received in a duel. It was taken to Tiflis, and buried in the monastery of St. David.

GRIESBACH, JOHANN JAKOB, one of the most distinguished of the band of scholars to whom the modern science of New Testament textual criticism owes its origin, was born at Butzbach, a small town of Hesse-Darmstadt, where his father was pastor, January 4, 1745. At the close of his undergraduate career, he undertook a literary tour which, apart from the advantages of stimulative contact with many of the most distinguished scholars of England, France and Holland, as well as of his own country, was of great utility to him in providing him with materials for the great work of his subsequent life. On his return to Halle, he acted for some time as "privat-docent," but in 1773 was appointed to a professorial chair; in 1775 he was translated to Jena, where the remainder of his life was spent in ever-increasing usefulness and honor, and where he died March 24, 1812.

GRIFFIN, or GRYPHON, in the natural history of the ancients, the name of an imaginary rapacious creat-

ure of the eagle species, represented with four legs, wings and a beak — the fore part resembling an eagle, and the hinder a lion. In addition, some writers describe the tail as a serpent. This animal, which was supposed to watch over gold mines and hidden treasures and to be the enemy of the horse, was consecrated to the sun; and the ancient painters represented the chariot of the sun as drawn by griffins. According to Spanheim, those of Jupiter and Nemesis were similarly provided.

GRIFFIN, GERALD, an Irish novelist and dramatic writer, was descended from a family of good position and was born at Limerick, December 12, 1803. In London he obtained occupation as a parliamentary reporter, and gradually the *Literary Gazette*, the *News of Literature*, and other periodicals of standing began to look upon his contributions with favor. Some of his dramatic pieces were accepted also by one of the theaters; and the publication in 1827 of a series of tales under the title of *Holland Tide* was so successful that he at once set about the preparation of a similar series which appeared the same year in two volumes under the title of *Tales of the Munster Festivals*, and were still more popular. In 1828 appeared the *Collegians*, afterward so successfully adapted for the stage under the title of the *Colleen Bawn*. It is said to have been the favorite novel of O'Connell; and besides exhibiting that masterly delineation of both the pathetic and the humorous features of Irish character already shown in his other works, it was written with a verve and a dramatic intensity and realism far surpassing all his previous or subsequent efforts. His principal other works are *The Invasion*, *The Rivals*, *Tracy's Ambition*, and *The Tales of Five Senses*. He was admitted into a Dublin monastery in September, 1838 under the name of Brother Joseph, and in the following summer he removed to Cork, where he died of typhus fever June 12, 1840.

GRILLPARZER, FRANZ, a distinguished German dramatist, was born in Vienna on January 15, 1791. In 1847 he was made a member of the Academy of Sciences. From early youth he displayed a strong literary impulse. He devoted especial attention to the Spanish drama, and nearly all his writings bear marks of the influence of Calderon. When he began to write, the German stage was dominated by the wild plays of Werner, Müllner and other authors of the so-called "fate-tragedies." His first play, *Die Ahnfrau* (The Ancestress), published in 1816, was penetrated by their spirit. Another and more ambitious work in the classic style was *Das goldene Vlies* (The Golden Fleece), a trilogy published in 1822. Of its three parts the greatest is *Medea*, which some critics consider his highest achievement. In *Waves of the Sea and of Love*, which appeared in 1840, Grillparzer again formed his work on classic models. The subject is the story of *Hero and Leander*, and it has never been more happily treated than in some passages, which, however, are marked rather by lyrical than dramatic qualities.

In 1825 Grillparzer published *King Ottocar's Fortune and End*. It appealed strongly to the patriotic sympathies of Vienna, dealing as it does with one of the proudest periods of Austrian history — the time of Rudolf I., the founder of the house of Hapsburg.

After 1840, when his solitary comedy was rejected by the public, he almost passed from the memory of his contemporaries. Fortunately for him, Heinrich Laube, an admirer of his genius, settled in Vienna in 1849 as artistic director of the court theater. By and by Laube reintroduced on the stage some of the forgotten works, and their success was immediate and profound. To his own surprise, Grillparzer became the most popular author of the day; he was ranked with Goethe and

Schiller, and lauded as the national poet of Austria. On the eightieth anniversary of his birthday all classes from the court downward united to do him honor; never, probably, did Vienna exert herself so much to prove her respect for a private citizen. He died on January 21, 1872, and was buried with an amount of ceremony that surpassed even the pomp displayed at Klopstock's funeral. A monument of him has recently been erected at Baden, near Vienna.

GRIMALDI, GIOVANNI FRANCESCO, an architect and painter, named Il Bolognese from the place of his birth, was a relative of the Caracci family, under whom it is presumed he studied first, and afterward under Albano. He went to Rome, and was appointed architect to Pope Paul V., and patronized by succeeding popes also. Toward 1648 he was invited to France by Cardinal Mazarin, and for about two years was employed in buildings for that minister and for Louis XIV., and in fresco-painting in the Louvre. Returning to Rome, he was made president of the Academy of St. Luke; and in that city he died on November 28, 1680, in high repute not only for his artistic skill but for his upright and charitable deeds as well.

GRIMM, FRIEDRICH MELCHIOR, BARON VON, the author of the celebrated *Correspondance littéraire*, was, though a naturalized Frenchman, both of German descent and a native of Germany, having been born of poor parents at Ratisbon, December 26, 1723. He studied at the university of Leipsic, where he had as professor the celebrated Ernesti, to whom he was doubtless in no small degree indebted for his critical appreciation of classical literature. On completing his studies he made his literary début by a tragedy which was received with ridicule by the audience and by the critics, including Lessing, and which is now forgotten even in Germany. In 1749 he made the acquaintance of J. J. Rousseau, which, through a mutual sympathy in regard to musical matters, soon ripened into intimate friendship. Through Rousseau he was introduced to the Encyclopedists, and about the same time he became secretary to Count Friesen, nephew of Marshal Saxe, which gained him admission to the most brilliant society of Paris. He rapidly obtained a thorough knowledge of the French language, and acquired so perfectly the tone and sentiments of the society in which he moved that all marks of his foreign origin and training seemed completely effaced. In 1753 Grimm was engaged by the Abbé Raynal to aid him in conducting his literary correspondence with German sovereigns; and this opened up to him that sphere for his ambition which perhaps was most in accordance with his peculiar tastes, and in which his abilities best fitted him to excel. Although from the beginning he had the principal share in the work, it was probably conducted until 1759 in the name of the Abbé Raynal. With the aid of friends during his temporary absences from France, he carried it on until 1790, and it latterly extended to six sovereigns, including the empress of Russia, the king of Sweden, and the king of Poland. It was probably in 1754 that Grimm was introduced by Rousseau to Madame d'Épinay, his relations with whom led to an irreconcilable rupture between him and Rousseau. The exact amount of Grimm's blameworthiness it is impossible to determine, and the whole matter would be of little consequence but for the fact that Rousseau allowed his resentment to gain such a complete possession of his mind as to induce him to give in his *Confessions* a wholly mendacious portrait of Grimm's character, by which his reputation was for a considerable time injuriously affected. After the death of Count Friesen Grimm obtained the patronage of the duke of Orleans, through whom he was appointed

secretary to Marshal d'Estrées during the campaign of Westphalia in 1756-57. Subsequently he was named minister of Saxe-Gotha at the court of France, but he was deprived of that office on account of having criticised rather caustically certain French ministers in a dispatch that was intercepted by Louis XV. His introduction to Catherine II. of Russia took place in 1773, when he accompanied the suite of the landgrave of Hesse-Darmstadt to St. Petersburg on occasion of the marriage of a daughter of that prince to the only son of Catherine. After the Revolution Grimm retired to Gotha, and in 1792 he emigrated to Russia, where he enjoyed high favor at the court of Catherine, and had assigned him the nominal and agreeable duty of entertaining her for so many hours a day by his conversation. This state of things came, however, to an end in 1795, when, notwithstanding his supplications to be retained at court if only as one of her majesty's dogs, he was appointed minister of Russia at Hamburg. He died at Gotha, December 19, 1807.

GRIMM, JACOB LUDWIG CARL (1785-1863), was born January 4, 1785, at Hanau, in Hesse-Cassel. His father, who was a lawyer, died while he was still a child, and the mother was left with very small means; but her sister, who was lady of the chamber to the landgravine of Hesse, helped to support and educate her numerous family. Jacob with his younger brother Wilhelm (born on February 24, 1786) was sent in 1798 to the public school at Cassel. In 1802 he proceeded to the university of Marburg, where he applied himself to the study of law. His brother joined him at Marburg a year later, and likewise began the study of law. Up to this time Grimm had been actuated only by a general thirst for knowledge and the instinct of intellectual activity, and his energies had not found any aim beyond the practical one of making himself a position in life. The first definite impulse came from the lectures of Savigny, the celebrated investigator of Roman law, who, as Grimm himself says (in the preface to the *Deutsche Grammatik*), first taught him to realize what it meant to study any science, whether that of law or any other. Savigny's lectures at the same time awakened in him that love for historical and antiquarian investigation which forms the basis of all his work. Then followed personal acquaintance, and it was in Savigny's well provided library that Grimm first turned over the leaves of Bodmer's edition of the Old German minnesingers and other early texts, and felt an eager desire to penetrate further into the obscurities and half-revealed mysteries of their language. In the beginning of 1805 he received an invitation from Savigny, who had removed to Paris to continue his researches among the libraries there, to join him and help him in his literary work. This offer was accepted by young Grimm, who passed a very happy time in Paris, enjoying the society of Savigny, and strengthening his taste for the literatures of the Middle Ages by his studies in the Paris libraries. Toward the close of the year he returned to Cassel, where his mother and Wilhelm had settled, the latter having finished his studies. The next year he obtained a situation in the war office with the very small salary of 100 thalers. One of his grievances was, as he himself tells us in his autobiography, that he had to exchange his stylish Paris suit for a stiff uniform and pigtail. But he had full leisure for the prosecution of his studies. In 1808, soon after the death of his mother, he was appointed superintendent of the private library of Jerome Bonaparte, king of Westphalia, into which Hesse-Cassel had been incorporated by Napoleon. He was treated with marked favor by the king, who appointed him an auditor to the state council, while he still retained his other post.

His salary was increased in a short interval from 2,000 to 4,000 francs, which removed all anxiety as to the means of subsistence, and his official duties were hardly more than nominal. After the expulsion of Jerome and the reinstallation of an elector, Grimm was appointed in 1813 secretary of legation to accompany the Hessian minister to the headquarters of the allied army. In 1814 he was sent to Paris to demand restitution of the books carried off by the French, and in 1814-15 he attended the congress of Vienna as secretary of legation. On his return he was again sent to Paris on the same errand as before. Meanwhile Wilhelm had received an appointment in the Cassel library, and in 1816 Jacob was made second librarian under Völkel. On the death of Völkel in 1828 the brothers expected to be advanced to the first and second librarianships respectively, and were much dissatisfied when the first place was given to Rommel, keeper of the archives. So they removed next year to Göttingen, where Jacob received the appointment of professor and librarian, Wilhelm that of under-librarian. Jacob Grimm lectured on legal antiquities, historical grammar, literary history, and diplomatics, explained Old German poems, and commented on the *Germania* of Tacitus. In 1837, being one of the seven professors who signed a protest against the king of Hanover's abrogation of the constitution which had been established some years before, he was dismissed from his professorship, and banished from the kingdom of Hanover. He returned to his native Cassel together with his brother, who had also signed the protest, and remained there till, in 1840, they accepted an invitation from the king of Prussia to remove to Berlin, where they both received professorships, and were elected members of the Academy of Sciences. Not being under any obligation to lecture, Jacob very seldom did so, but together with his brother worked at the great dictionary, the plan of which had already been partly developed. During their stay at Cassel Jacob regularly attended the meetings of the academy, where he read papers on the most varied subjects. The best known of these are those on Lachmann, Schiller, and his brother Wilhelm (who died in 1859), on old age, and on the origin of language. He also described his impressions of Italian and Scandinavian travel, interspersing his more general observations with linguistic details, as is the case in all his works. He died in 1863, working up to the last.

GRIMM, WILHELM CARL (1786-1859). The chief events in the life of Wilhelm Grimm have been narrated in last article. The two brothers were indeed so intimately associated both in their lives and in their works that a separate biography of the younger is almost superfluous. As Jacob himself said in his celebrated address to the Berlin Academy on the death of his brother, the whole of their lives were spent together. In their schooldays they had one bed and one table in common, as students they had two beds and two tables in the same room, and they always lived under one roof, and had their books and property in common. Nor did Wilhelm's marriage in any way disturb their harmony. Wilhelm's character was a complete contrast to that of his brother. As a boy he was strong and healthy, but as he grew up he was attacked by a long and severe illness, which left him weak all his life. His was a less comprehensive and energetic mind than that of his brother, and he had less of the spirit of investigation in him, preferring to confine himself to some limited and definitely bounded field of work; he utilized everything that bore directly on his own studies, and ignored the rest.

GRIMMA, a town in the circle of Leipsic, Saxony, is situated on the left bank of the Mulde, nineteen miles southeast of Leipsic. Population (1890), 7,000.

GRIMSBY, GREAT, a municipal and parliamentary borough and seaport town of England, county of Lincoln, is situated on the south side of the estuary of the Humber nearly opposite Spurn Head, and seventeen miles east-southeast of Hull. Population (1890), 30,000.

GRINDAL, EDMUND, archbishop of Canterbury, was born at Hensingham in the parish of St. Bees, Cumberland, about 1519. He was educated at Cambridge, where he became fellow of Pembroke Hall in 1538, and president in 1549. In the following year he was appointed chaplain to Bishop Ridley, in August, 1551, precentor of St. Paul's, in November chaplain to Edward VI., and in July, 1552, prebendary of Westminster. On the accession of Mary in 1553 he took refuge on the continent, where he acquired a competent knowledge of German, and occupied himself also in collecting the "writings and stories of the learned and pious sufferers in England"—the result of his inquiries being afterward communicated to John Foxe, and incorporated by him in his *Book of Martyrs*. Returning to England under the new regime in 1558, he assisted in the preparation of the new liturgy, and was also one of the eight Protestant divines chosen to hold public disputes with the popish prelates. In 1559 he was appointed to the mastership of Pembroke Hall, and in the same year he succeeded Bonner as bishop of London. In 1570 Grindal was appointed to the see of York, from which he was translated to Canterbury in February, 1576. Having in the same year incurred the royal displeasure by refusing to suppress the meetings held among the clergy for "the exercise of prophesying," he was ultimately, in June, 1577, by order of the Star Chamber confined to his house and sequestered for six months. As in November he refused to make a formal submission to the queen, his suspension was continued for several years; but though a petition for his restoration, which was drawn up by convocation in 1580, was not immediately granted, it would appear that in 1582 he had resumed, at least partially, the exercise of his ecclesiastical functions. About the end of this year the queen, on account of his blindness, requested him to retire on a pension, but the negotiations connected with his resignation were not completed till April, 1583, and it was only after his death at Croydon, July 6th of the same year, that Whitgift, who had been nominated his successor, entered upon the see.

GRINDSTONE. Sandstones which possess the property of abrading steel and other hard substances are extensively used in arts and manufactures under the name of grindstones. In its simplest form a grindstone consists of a stone disc, more or less circular, mounted on a horizontal iron spindle carried on the tops of two wooden posts fixed in the ground. A winch handle, or occasionally a rude crank with treadle, provides the means of giving a slow rotation to the stone, against the cylindrical face of which the steel or other substance which is to be ground is held. Such grindstones—possessing neither truth of figure nor the means of obtaining it—are unsuitable for any but the roughest purposes; and although by mounting them in a frame to which a rest can be attached it is possible to keep them true and tolerably efficient, they are always slow in their action.

GRINGOIRE, or GRINGON, PIERRE, was the last of the mediæval poets. He lived to see the old methods which he was taught to believe unchangeable entirely superseded.

The place of his birth is uncertain. Perhaps it was Lorraine, perhaps Normandy. His real name was Gringon, which he changed to Gringoire, for the poetical reason that it sounded better. His early history is almost entirely unknown; at the age of nineteen

or twenty he produced his first poem, *Le Chateau de Labour*, in which he is supposed to have narrated his own experiences. Most probably he did. Finding that the trade in allegorical poems was ruined for want of demand, and discovering an opening in the direction of mysteries, Gringoire began to produce those dramas, and joined the "Enfants de Sans Souci." The fraternity advanced him to the dignity of "Mère Sotte," and afterward to the highest honor of the guild, that of "Prince des Sots."

Among his principal works are *Les Folles Enterprises* and *Les Abus du Monde*,—poems in which everything under the sun is criticised,—certain political pieces, such as *La Chasse du Cerf des Cerfs* and *La Mère Sotte*, with all her literary offspring. During the last twenty years of a long life he became orthodox and contributed the *Blason des Heretiques* to orthodox literature. It was during this period also that he wrote the work by which he is best known, the *Mystère de la Vie de Saint Louis*, of which an analysis may be found in M. Leroy's *Études sur les Mystères*. After more than three hundred years of oblivion this poet has been republished, not so much on account of his own merits as because of the position which he occupies in the history of dramatic literature.

GRIQUALAND WEST, a province in South Africa, comprising the territory formerly belonging to the western division of the Griqua people; which was annexed to the British empire October 27, 1871. The extent of the province is 17,800 square miles. It is bounded on the south by the Orange River (which separates it from the Cape Colony), on the north and north-east by territory occupied by the Bechuana tribes and the Transvaal settlement, and on the east by the Orange Free State. A portion of the territory is adapted for sheep-farming, and the river basins contain fertile land suitable for agricultural purposes. But the great wealth of the country is in its diamond mines. Since the first discovery of diamonds, in 1867, the total value of the gems exported from the province is estimated at \$200,000,000. Digging operations were at first confined to the alluvial deposits on the banks of the Vaal River, but in 1871 mines were opened in the locality known as the "dry diggings," which have since received the names of Kimberley, De Beer's, Du Toit's Pan, and Bultfontein, all situated within a radius of a few miles. The area of the diamond-producing ground at each of these places is distinctly defined. At Kimberley the mine covers only nine acres, at De Beer's fourteen acres, at Du Toit's Pan forty-one acres, and at Bultfontein twenty-two acres. Kimberley, the chief center of the mining industry, is the capital of the province and the seat of government. There is a resident lieutenant-governor or administrator, who is assisted by an executive council, and a legislative council composed of members partly elective and partly nominated by the crown. There is also a high court of justice presided over by a resident recorder. The other towns are Du Toit's Pan (including Bultfontein), Barkly, and Griqualand Town. The villages and native locations are Hebron, Likatlong, Boetsap, Campbell, and Douglas. Among the river diggings or encampments are Pniel, Waldeck, Plant, Sifonell, and Setlacomie's. A census taken in 1877 showed the total population of Griqualand West at that time to be 45,277, of whom 12,347 were Europeans.

GRISONS (German, *Graubünden*) is the largest and easternmost of the Swiss cantons. It is eighty miles in length from east-northeast to west-southwest, and forty-five in breadth, and has an area of 2,963 square miles. On the northeast and east it abuts against the little principality of Liechtenstein, and the Austrian

provinces of Tyrol and Vorarlberg, on the south on the Italian provinces of Val Tellina and Como, and on the west and north on the Swiss cantons of Ticino, Uri, Glarus, and St. Gall.

The whole canton is mountainous, and, with the exception of the Rhine valley below Reichenau and the Italian valleys, which still form part of it, has a severe alpine climate and vegetation. One-tenth of the surface is covered by glaciers.

Since Roman times the passes of the Grisons have been among the most frequent routes across the Alps. The Julier and Bernina, the Septimer, Splügen, and Lukmanier, were the most used in the Middle Ages.

GRIVEGNÉE, a town of Belgium in the arrondissement and province of Liège, is situated on the Ourthe about a mile and a half southwest of Liège. Population (1890), 6,000.

GROCYN, WILLIAM, an English scholar of the fifteenth century, was born at Bristol about 1442. Designed by his parents for the church, he was sent to Winchester College, and there he remained till his twenty-second year, when he was elected to a scholarship at New College, Oxford. Having been chosen reader in divinity in Magdalen College in 1483, it fell to his lot to maintain a disputation with John Taylor, professor of divinity, in presence of King Richard III., and so well did he carry himself in the matter that the king sent him a buck and five marks. As lecturer in Exeter College he found an opportunity of indoctrinating his countrymen in the new learning, and had the honor of teaching Greek not only to Sir Thomas More but to Erasmus himself, who was indebted to him also for an introduction to Archbishop Warham. When, some time afterward, Grocyn removed to London, he was chosen by Dean Colet to deliver lectures in St. Paul's. He died in 1519.

GRODNO, a western province or government of Russia in Europe, bounded north by Vilna, east by Minsk, south by Volhynia, and west by the former kingdom of Poland; area, 14,961 square miles. In 1870 the population was 1,008,521, comprising Lithuanians, Russians, Poles, Tartars, and a few German colonists.

GRODNO, capital of the province of the same name, stands on the right bank of the Niemen, and is connected by railway with St. Petersburg, Moscow, and Warsaw. Pop. (1890), 25,000.

GROEN VAN PRINSTERER, WILHELM, Dutch statesman, historian, and publicist, was born at Voorburg, on August 21, 1801, received his grammar school education at the Hague, and studied law, philosophy, and history at the university of Leyden. At the age of twenty-five he published a volume of miscellaneous essays (*Verspreide Geschriften*, 1826), and in 1827 he was appointed private secretary to King William I. From this post he retired in 1833, in order that he might devote himself with less interruption to historical researches. He entered the chamber of representatives in 1840, and took part with both tongue and pen in all the more important discussions of the years that followed, especially in those of 1848 and 1849. Between 1849 and 1865 he frequently sat in the second chamber, and from 1850 to 1855 the anti-liberal newspaper *Nederlander* was managed by him. The mortification which European events in 1864 and 1866 had caused him, found expression in the occasional writings entitled *La Prusse et les Pays-Bas*, *À mes amis à Berlin*, and *L'Empire Prussien et L'Apocalypse* (1867). Shortly afterward he withdrew entirely from public affairs, but continued his literary pursuits, his latest production *Maurice et Barneveldt*, an able vindication of the Calvinistic prince as against the Armenian statesman, hav-

ing been completed (1875) only a short time before his death, which occurred May 19, 1876.

GRONINGEN, a town of the Netherlands, in the province of the same name, is situated on the Hunse at the influx of the Aa, forty-five and a-half miles in an eastward direction from Harlingen. Population (1890), 54,000.

GRONOVIVS, or GRONOV, JAKOB, one of the very great scholars of the seventeenth century, was born October 20, 1645, at Deventer, where his father, J. F. Gronovius, was at that time professor of rhetoric and history. On the completion of his studies at Leyden, where he had early distinguished himself by his powers of intellectual acquisition, he in 1698 visited England, where he became acquainted with Pocock, Pearson, and Mery Casaubon, and where he devoted several months to the collation of rare manuscripts at Oxford and Cambridge. His edition of Polybius, published at Leyden in 1670, in addition to his own and variorum notes, contained those which Casaubon on his deathbed had bequeathed to him. Declining an invitation to a chair at Deventer, he in 1671 visited France, and was brought into intimate relations with D'Herbelot, Thevenot, and other distinguished scholars; and after another brief interval at Leyden he in 1672 traveled in Spain, whence he passed into Italy. There he accepted from the grand duke of Tuscany a chair at the university of Pisa, which, however, he resigned at the end of two years. Having returned to Deventer by way of Germany, he had settled down with the purpose of working uninterruptedly at an edition of Livy, when in 1679 he was invited by the curators of the university of Leyden to occupy a professorial chair. He died October 21, 1716.

GRONOVIVS, or GRONOV, JOHANN FRIEDRICH, scholar and critic, was born at Hamburg, September 20, 1613. He went through his early studies with great distinction at Bremen, and afterward attended the universities of Leipsic, Jena, and Altorf, whence he extended his travels into France and Italy. In 1643 he was appointed professor of rhetoric and history at Deventer, and in 1658 he succeeded Daniel Heinsius in the Greek chair at Leyden, where he died on December 28, 1671.

GROOT, GERHARD, founder of the society of "Brethren of the Common Life," was born in October 1340, at Deventer, where his father held a good civic position. Other forms of the family name are Groote, Groet and Groete. At the close of his school education, received partly at Deventer and partly at Aix-la-Chapelle and Cologne, Gerhard ("Gerrit" or "Geert") in his fifteenth year entered the university of Paris, where he made distinguished progress in almost all the branches of learning then cultivated—canon law, medicine, astrology and even magic being added to the theology and philosophy of the schoolmen. We next hear of him as learning and teaching in Cologne; according to one account he studied also at Prague; and in 1366 he visited, on public business it is presumed, the papal court at Avignon. About this time he was appointed to a couple of canonries at Utrecht and Aix-la-Chapelle respectively, and the life of the brilliant young scholar was rapidly becoming luxurious, secular, and selfish, when a great spiritual change passed over him which resulted in a final renunciation of every worldly enjoyment. Between 1374 and 1379 Gerhard had also spent some three years in all at Munnikhuizen in study and prayer; and in the course of the last-mentioned year he left the privacy of the cloister, and having received ordination as a deacon, became a missionary preacher within the diocese of Utrecht. The success which followed his labors, not only in the town

of Utrecht itself, but also in Zwolle, Kampen, Leyden, Delft, Gouda, Amsterdam, and many other places, was immense; according to Thomas à Kempis, the people left their business and their meals to hear his sermons, so that the churches could not hold the crowds that flocked wherever he came. By a skillfully framed episcopal edict of 1383, which excluded from the pulpit all who had not received priest's orders, his public preaching was brought abruptly to an end; an appeal to Urban VI. was made in vain. After a comparatively brief life of singular energy, patience, and self-denial, Groot fell a victim to the plague at Deventer on August 20, 1384.

GROS, ANTOINE JEAN, BARON, the pupil of David and the forerunner of Géricault, occupies a peculiar position between the classic and romantic schools which divided opinion at the beginning of the present century. He was born at Paris in 1771. Toward the close of 1785 Gros, by his own choice, entered the studio of David, which he frequented assiduously, continuing at the same time to follow the classes of the Collège Mazarin. The death of his father, whose circumstances had been embarrassed by the Revolution, threw Gros, in 1791, upon his own resources. He now devoted himself wholly to his profession, and competed in 1792 for the *grand prix*, but unsuccessfully. About this time he was, however, on the recommendation of the École des Beaux Arts, employed on the execution of portraits of the members of the Convention, and when—disturbed by the development of the Revolution—Gros in 1793 left France for Italy, he supported himself at Genoa by the same means, producing a great quantity of miniatures and *fixés*. He visited Florence, but returning to Genoa made the acquaintance of Josephine, and followed her to Milan where he was well received by her husband. On November 15, 1796, Gros was present with the army near Arcola when Bonaparte planted the tricolor on the bridge. Gros seized on this incident, and showed by his treatment of it that he had found his vocation. Bonaparte at once gave him the post of "inspecteur aux revues," which enabled him to follow the army, and in 1797 nominated him on the commission charged to select the spoils which should enrich the Louvre. In 1799, having escaped from the besieged city of Genoa, Gros made his way to Paris, and in the beginning of 1801 took up his quarters in the Capucins. *Les Pestiférés de Jaffa* (Louvre), was followed by the *Battle of Aboukir*, 1806 (Versailles), and the *Battle of Eylau*, 1808 (Louvre). These three subjects—the popular leader facing the pestilence unmoved, challenging the splendid instant of victory, heart-sick with the bitter cost of a hard-won field—gave to Gros his chief titles to fame. In 1810 his *Madrid* and *Napoleon at the Pyramids* (Versailles), show that his star had deserted him. His *Francis I.* and *Charles V.*, 1812 (Louvre), had considerable success; but the decoration of the dome of St. Geneviève (begun in 1811 and completed in 1824) is the only work of Gros' later years which shows his early force and vigor, as well as his skill. The *Departure of Louis XVIII.* (Versailles), the *Embarkation of Madame d'Angoulême* (Bordeaux), the plafond of the Egyptian room in the Louvre, and finally his *Hercules and Diomedes*, exhibited in 1835, testify only that Gros' efforts—in accordance with the frequent councils of his old master David—to stem the rising tide of Romanticism served but to damage his once brilliant reputation. Exasperated by criticism and the consciousness of failure, Gros sought refuge in the grosser pleasures of life, but suddenly his vital forces failed him, and on June 25, 1835, he was found drowned on the shores of the Seine near Sèvres.

GROSBEAK, a name very indefinitely applied to many birds belonging to the families *Fringillidae* and *Ploceidae* of modern ornithologists, and perhaps to some members of the *Emberizidae* and *Tanagridae*, but always to birds distinguished by the great size of their bill. Taken alone it is commonly a synonym of HAWFINCH, but a prefix is most usually added to indicate the species, as Pine-Grosbeak, Cardinal-Grosbeak, and the like.

The PINE-GROSBEAK is, with the exception of the Hawfinch just mentioned, the best known species to which the name is applied. It inhabits the conifer-zone of both the Old and the New Worlds, seeking, in Europe and probably elsewhere, a lower latitude as winter approaches—often journeying in large flocks.

The VIRGINIAN GROSBEAK, or Virginian Nightingale of many writers, *Cardinalis virginianus*, next claims notice here, though doubts may be entertained as to the family to which it really belongs. No less remarkable for its bright carmine attire, and the additional embellishment of an elongated crest of the same color, than for its fine song, it has been an object of attraction almost ever since the settlement of its native country by Europeans. All American ornithologists speak of its easy capture and its ready adaptation to confinement, which for nearly three centuries have helped to make it a popular cage-bird on both sides of the Atlantic. The vocal powers possessed by the cock are to some extent shared by the hen, though she is denied the vivid hues of her partner, and her plumage, with exception of the wings and tail, which are of a dull red, is light olive above and brownish-yellow beneath. This species inhabits the eastern parts of the United States southward of 40° N. latitude, and also occurs in the Bermudas. It is represented in the southwest of North America by other forms that by some writers are deemed species, and in the northern parts of South America by the *C. phæniceus*, which would really seem entitled to distinction. Another kindred bird, placed from its short and broad bill in a different genus, and known as the Texan Cardinal, is found on the southern borders of the United States and in Mexico; while among North American "Grosbeaks" must also be named the birds belonging to the genera *Guiraca* and *Hedymeles*—the former especially exemplified by the beautiful blue *G. cerulea*, and the latter by the brilliant rose-breasted *H. ludovicianus*, which last extends its range into Canada.

GROSE, FRANCIS, a celebrated English antiquary, son of a wealthy Swiss jeweler, settled in England, was born at Greenford, in Middlesex, about the year 1730. The bias of his mind toward heraldry and antiquities showed itself early, and his father, indulging it, procured him a position in the Herald's College. In 1757 he was elected fellow of the Society of Antiquaries. In 1773 he began to publish his *Antiquities of England and Wales*, a work which brought him money as well as fame. This, with its supplementary parts relating to the Channel Islands, was not completed till 1787. In 1789 he set out on an antiquarian tour through Scotland, and in the course of this journey met Burns, who composed in his honor the famous song beginning, "Ken ye aught o' Captain Grose," and in that other poem, still more famous, "Hear, land o' cakes, and brither Scots," warned all Scotchmen of this "chield amang them taking notes." In 1790 he began to publish the results of what Burns called "his peregrinations through Scotland;" but he had not finished the work when he bethought himself of going over to Ireland and doing for that country what he had already done for Great Britain. About a month after his arrival, however, while in Dublin, at the table of his friend Hone,

he was seized with an apoplectic fit, and died in a moment, June 12, 1791.

GROSSENHAIN, a town in the circle of Dresden, Saxony, is situated on the Röder, an affluent of the Elbe, twenty miles northwest of Dresden. Pop. (1890), 15,600.

GROSSETESTE, ROBERT, in some respects the most distinguished of all the English mediæval prelates as regards his personal influence both over the men of his time and on its literature, was born of humble parents at Stradbroke in Suffolk about the year 1175. He was sent by his friends to Oxford, where he studied law and medicine, and seems to have finished his education at Paris, where he probably laid the foundation of his knowledge of Greek and Hebrew. From Paris he returned to Oxford, graduated in divinity, and became master of the schools (*rector scholarum*) or chancellor. He also became the first rector of the Franciscans at Oxford. Here he probably wrote his commentaries on Aristotle, and laid the foundation of his fame as a preacher. His earliest preferment of which we can speak with certainty was the archdeaconry of Wilts, which he held in 1214 and 1220; he was archdeacon of Northampton in 1221, holding at the same time the prebend of Empingham, which belonged to the archdeaconry. This he exchanged for the archdeaconry of Leicester, which he probably held till 1232. In May, 1225, he was collated by Hugh de Wells, bishop of Lincoln, to the church of Abbotsley, Hunts, and at one time he held the rectory of St. Margaret's, Leicester. On the death of Bishop Hugh de Wells in February, 1235, the chapter of Lincoln elected Grosse-teste to the see; the election took place on March 27th; and he was consecrated at Reading on June 17th. His administration of his diocese, then the most extensive in the country, was characterized by great vigor. His energy in his visitations did not pass without opposition; an attempt on his life by poison was made in 1237, from which he recovered with difficulty through the help of John de S. Giles; and in 1239 began the quarrel with the chapter of Lincoln, which lasted six years, and was quieted by the decision of the pope himself. He died in 1253.

GROSSETO, a town of Italy, at the head of the province of the same name, is situated in the Maremma district, near the right bank of the Ombrone-Senese, with a station on the railway between Florence and Rome. Population (1890), 4,150.

GROSSI, TOMMASO, Lombard poet and novelist, was born at Bellano, on the Lake of Como, January 20, 1791. In 1816 he published two poems written in Milanese — *The Golden Rain* and *The Fugitive*. These compositions secured him the friendship of Porta and Manzoni, and the three poets came to form a sort of romantic literary triumvirate.

He next set about writing an epic poem, entitled *The Lombards in the First Crusade*, a work of which Manzoni makes honorable mention in his *Betrothed*. This composition, which was published by subscription (1826), attained a success that has not been equaled by that of any other Italian poem within the century. The example of Manzoni, who had meanwhile published *The Betrothed* (1827), induced his friend Grossi to enter the same arena with an historical novel entitled *Marco Visconti* (1834). A little later Grossi published a tale in verse, *Ulrico and Lida*. After his marriage in 1838 he continued to employ himself as a notary in Milan till his death on December 10, 1853.

GROSSWARDEIN (Hungarian, *Nagy-Várad*, a royal free city, and capital of the county of Bihar, in the Trans-Tibiscan circle, Hungary, is situated in a beautiful plain on the banks of the river Sebeskörös. Population (1890), 30,000.

GROTE, GEORGE, the historian of Greece, eminent also as a philosopher, a politician, and a laborer in the advancement of university education, was born November 17, 1794, at Clay Hill, near Beckenham in Kent. He drew his lineage from a Dutch, or, more strictly speaking, a Low German family. The name (Groot, equivalent to "great,") is the same as that of Hugo Grotius, with whom the Grotes would gladly have traced a relationship, but the evidence was wanting. Arrived at the age of manhood (in the winter of 1814-1815), he formed the acquaintance of the young lady who afterward became his wife, devoted to and worthy of him, the very complement of his life, intellectual as well as social, and finally his biographer in a spirit of loving but not indiscriminate admiration. This was Miss Harriet Lewin, the daughter of Mr. Thomas Lewin, of Bexley, in Kent, a gentleman of old family and independent fortune. She was born at Southampton, July 1, 1792, and was consequently nearly two years older than Grote. From causes which need not be related here, their intimacy was suspended for three years, during which Grote's studies made steady progress. The most interesting light is thrown on the method and course of his studies in the diary which he kept for Miss Lewin's information. This record bears witness, not only to the wide diversity of his studies in ancient and modern literature, philosophy and political economy, but also to the fact that he read the authors themselves whom he wished to know — read them as a whole, instead of merely reading what others had written about them.

An epoch, perhaps the most critical turning-point of Grote's intellectual life, was formed by his introduction, through David Ricardo, to James Mill, who was then composing his metaphysical work entitled *An Analysis of the Human Mind*. Already attracted to this study, Grote became Mill's admiring disciple in mental and political philosophy. The views derived from Mill were confirmed by the teaching of Jeremy Bentham, and by intercourse with a band of young disciples, over whom the two philosophers wielded an unbounded influence. Among these John Stuart Mill began now to make his appearance as a boy of twelve years old.

In 1820, at the age of twenty-four, Grote was married to Miss Harriet Lewin. They lived at first at the banking-house in Threadneedle street. The confined situation soon told on Mrs. Grote's health, and the death of her only child, a week after its birth, was followed by a dangerous illness. It was at her bedside at Hampstead, during her slow recovery, that Grote composed the first work he published, an *Essay on Parliamentary Reform*, in reply to an article by Sir James Mackintosh in the *Edinburgh Review*, No. 61 (1821). The most important parts of this pamphlet were embodied in his later essay on the *Essentials of Parliamentary Reform* (1831), reprinted in his *Minor Works*.

In April, 1822, Grote sent a vigorous letter to the *Morning Chronicle* in reply to Canning's speech against Lord John Russell's motion for reform. In the same year he spent much time upon some MSS. of Jeremy Bentham, which the aged philosopher intrusted to his young disciple to put into a readable form. After carefully digesting and arranging them, he published them anonymously in a small 8vo volume. A circle of congenial minds frequented the house in Threadneedle street from 1822 to 1830. Within that choice society there was a narrower circle of students, who met there twice a week at half-past eight in the morning for an hour or two's reading. Among others were John Stuart Mill, Charles Buller, and John Arthur Roebuck. They read the most recent works on metaphysics and

kindred subjects in the light of their adored teachers, Bentham and James Mill, beyond whom they believed all to be in Cimmerian darkness.

The year 1823 marks the epoch of the first conception of Grote's great work; and an extant letter shows the spirit in which he approached it. On January 14th he writes: "I am at present engaged in the fabulous ages of Greece, which I find will be required to be illustrated by bringing together a large mass of analogical matter from other early histories, in order to show the entire uncertainty and worthlessness of tales to which early associations have so long familiarized all classical minds. I am quite amazed to discover the extraordinary greediness and facility with which men assert, believe, re-assert and are believed."

Meanwhile he gave the world an earnest of his work in an exhaustive review of Mitford's *History of Greece* in the *Westminster Review* for April, 1826 — one result of which was a letter from Niebuhr, clearly designating Grote as the historian of Greece, and inviting him to a visit which events never permitted him to pay.

From 1825 to 1827 Grote took part in the scheme of founding the "University of London" in Gower street, with the management of which institution he became afterward intimately connected. As the political crisis of 1830 approached, public and private events conspired to draw Grote into the vortex of politics. The failure of his father's health gave him a new position in the bank; and, in the spring of 1830, he was able to arrange for a visit to the Continent, which brought him into connection with the liberal politicians of Paris on the eve of the revolution. He refused an invitation to stand for the city in 1831; but he made an able contribution to the argument in a statement of the *Essentials of Parliamentary Reform*, published this year, to which reference has already been made. His reluctance to enter parliament was overcome after the passing of the Reform Act in 1832; and, being returned at the head of the poll, he appeared as one of the members for the city of London in the first reformed parliament, which met on February 4, 1833. He at once gave notice of a motion for the vote by ballot in parliamentary elections, which he brought before the house on April 25th following. His speech on that occasion was prepared with great care, and displayed that cogent reason and calm earnest eloquence which marked all his efforts. He sat in three successive parliaments, from 1833 to 1841, witnessing the gradual passage from the first triumphs of reform to the Conservative reaction under Sir Robert Peel, and the steady decay of his own sect of philosophical radicalism, which never had a root in popular opinion. He was returned the last time by a bare majority of six, and his party in parliament numbered just the same figure.

During the eight years and a half of his parliamentary life, Grote kept up his varied reading, and formed a growing desire for a knowledge of physical science. But the staff of his mental diet, and his refuge from all meaner objects of thought, was still the same. In the weary intervals of attendance on parliament a copy of Plato was ready in his pocket, and, when snowed up in the country during the vacation, he writes — "A Greek book is the only refuge." His hospitalities expanded with his social position; and, among his new friendships, the one he most valued was that formed in 1835 with Mr. (afterward Sir) George Cornwall Lewis, the letters exchanged with whom on various points in classics and philosophy enrich the narrative of his *Life*. Among the other objects of his literary interest at that time was Sir William Molesworth's collected edition of the works of Hobbes, dedicated to Grote, whose review of the first two volumes in the *Spectator* (1839) is reprinted among the *Minor Works*.

During the whole period of Whig decay, and especially from the beginning of the present reign, Grote felt a declining interest in politics, and accordingly, on the dissolution in June, 1841, he determined to retire from parliament. Thus, at the age of forty-six, he was set free to spend the remaining thirty years of his life in the work long prepared and contemplated. In half that period the *History of Greece* was finished; the remaining half was devoted to the two works on Plato and Aristotle, which made up the Hellenic "trilogy" of his life-long studies.

After a six months' holiday (1841-1842), for the long desired purpose of visiting Italy and studying the antiquities of Rome upon the spot, he returned to his business at the bank, and set vigorously to work on the new plan for the first two volumes of his *History* — reperusing the authorities, revising his notes, and rewriting the whole. The greater part of these two volumes was occupied with the first division of his subject, which was now for the first time severed from actual history, and placed in its proper mythical light, under the title of *Legendary Greece*.

With the beginning of 1843, exactly ten years after the interruption caused by his entrance into parliament, the composition of the first volume for the press was vigorously begun; and at midsummer he further cleared his path by retiring from the banking-house of Prescott, Grote & Company. While still at work upon the *History*, he published in the *Classical Museum* (1844) an important essay on weights and measures, reviewing Boeckh's *Metrologische Untersuchungen*, which is reprinted among his *Minor Works*.

The first two volumes of the *History* were completed early in 1845, and published in March, 1846. The first volume and nearly half of the second are occupied with *Legendary Greece*; the latter half of the second volume begins *Historical Greece*, and consequently contains only a small portion of the real history. These volumes were reviewed with great praise by John Stuart Mill in the *Edinburgh Review*, and by Dean Milman in the *Quarterly Review*.

The success of the first two volumes incited Grote to prosecute the work with redoubled ardor; and such progress had been already made that the third and fourth volumes, bringing the narrative down to the battle of Marathon, and containing an account of Grecian poetry and philosophy in its earlier stages, appeared in the following year (1847). Two more volumes, the fifth and sixth, coming down to the eleventh year of the Peloponnesian war, were published in 1849. These two volumes, together with the two preceding ones, were reviewed in the *Edinburgh Review* by Sir George Cornwall Lewis. The seventh and eighth volumes, which brought the Peloponnesian war to the end, and which contained the striking and original view of the Sophists and of Socrates, appeared in 1850. Two articles in the *Quarterly Review* upon this portion of the work, one upon the history, and the other upon Socrates and the Sophists, were written by Dean Stanley. The ninth and tenth volumes were published in 1852, the eleventh in 1853, and the last and twelfth in 1856, just ten years after the appearance of the first two volumes. The work closes with the generation contemporary with Alexander the Great, "an epoch," the historian observes, "from whence dates not only the extinction of Grecian political freedom and self-action, but also the decay of productive genius, and the debasement of that consummate literary and rhetorical excellence which the fourth century B.C. had seen exhibited in Plato and Demosthenes."

After a well-earned holiday on the Continent in the summer of 1856, Grote set steadily to work upon his

Plato, which occupied him nine years, and appeared in 1865 in three volumes 8vo, under the title of *Plato and the other Companions of Sokrates*, when the author had completed his seventieth year. This work, he remarks, was "intended as a sequel and supplement to his *History of Greece*." After giving an exhaustive review of early Greek philosophy, from Thales to Democritus, and an account of the life of Plato, of the Platonic Canon, and of Platonic compositions generally, he analyses at great length each of the dialogues, with illustrative remarks, unfolding a number of his own philosophical views. The work concludes with two chapters, one on the "Other Companions of Sokrates," and another on "Xenophon."

On the completion of this work, Grote wrote in the *Westminster Review* (1866) an elaborate criticism of John Stuart Mill's *Examination of Sir William Hamilton's Philosophy*.

During the composition of the *Plato and the Aristotle* Grote resided in London, at 12 Savile Row, and in two country houses, which he occupied in succession, first at Barrow Green in Kent from 1859 to 1863 (where Jeremy Bentham had once lived), and afterward at Shiere among the Surrey hills, in which places his day was divided between regular work, exercise as regular, and the society of congenial friends. Many a work of social duty and benevolence found prompt performance; and he paid unremitting attention to the business of his three favorite institutions—the University of London, University College, and the British Museum, of which last he became a trustee on the death of Henry Hallam in 1859.

He continued to labor in the discharge of his duties to these institutions, even when far gone in the malady which appeared in 1870, and carried him off on June 18, 1871, in his seventy-seventh year. He found his fit resting-place in Westminster Abbey, just beneath Camden's monument, and near Macaulay's grave.

GROTEFEND, GEORG FRIEDRICH, to whose patience and ingenuity the decipherment of the cuneiform inscriptions was originally due, was born at Münden, in Hanover, June 9, 1775. He was educated partly in his native town, partly in Ilfeld, where he remained till 1795, when he entered the university of Göttingen, and there became the friend of Heyne, Tychsen, and Heeren. Heyne's recommendation procured for him an assistant mastership in the Göttingen gymnasium in 1797. While there he published his work, *De Pasigraphia sive Scriptura Universali* (1799), which first brought him into notice, and led to his appointment in 1803 as prorektor of the gymnasium of Frankfort-on-the-Main, and shortly afterward as conrektor. Grotefend was best known during his lifetime as a Latin and Italian philologist, though the attention he paid to his own language is shown by his *Anfangsgründe der deutschen Poesie*, published in 1815, and his foundation of a society for investigating the German tongue in 1817. In 1821 he became director of the gymnasium at Hanover, a post which he retained till his retirement in 1849, four years before his death. In 1823-4 appeared his revised edition of Wenck's Latin grammar, in two volumes, followed by a smaller grammar for the use of schools in 1826; in 1835-8 a systematic attempt to explain the fragmentary remains of the Umbrian dialect, and in 1839 a work of similar character upon Oscan. In the same year he published an important memoir on the coins of Bactria. He soon, however returned to his favorite subject, and brought out a work in five parts, *Zur Geographie und Geschichte von Altitalien* (1840-2). Previously, in 1836, he had written a preface to Wagenfeld's translation of the spurious *Sanchoniathon* of Philo Byblius, which professed to have been discovered in the preceding year

in the Portuguese convent of Santa Maria de Merinhao. But it was in the East rather than in the West that Grotefend did the work which has given him a lasting name. The mysterious cuneiform inscriptions of Persia had for some time been attracting attention in Europe; exact copies of them had been published by the elder Niebuhr, who lost his eyesight over the work; and Grotefend's friend, Tychsen of Rostock, believed that he had ascertained the characters in the column now known to be Persian to be alphabetic. At this point Grotefend took the matter up. His first discovery was communicated to the Royal Society of Göttingen in 1800. Grotefend died December 15, 1853.

GROTIUS, HUGO, in his native country Huig van Groot, but known to the rest of Europe by the Latinized form of the name, was one of the famous men of the seventeenth century, almost equally eminent for public services and as a writer. He was born at Delft on Easter day, April 10, 1583.

In the annals of precocious genius there is no greater prodigy on record than Hugo Grotius, who was able to make good Latin verses at nine, was ripe for the university at twelve, and at fifteen edited the encyclopædic work of Marcianus Capella. At Leyden he was much noticed by J. J. Scaliger, whose habit it was to engage young friends in the editing of some classical text, less for the sake of the book so produced than as a valuable education for themselves. At fifteen Grotius accompanied Count Justin of Nassau, and the grand pensionary Oldenbarnevelt on their special embassy to the court of France. After a year profitably spent in that country in acquiring the language and making acquaintance with the leading men, Grotius returned home. He took the degree of doctor of law at Leyden, and entered on practice as an advocate.

Notwithstanding his successes in his profession, which seemed to open the most brilliant career to his ambition, he was in secret hankering after the pleasures of literature. In 1600 he edited the remains of Aratus, with the versions of Cicero, Germanicus, and Avienus.

In 1603 the United Provinces, desiring to transmit to posterity some account of their struggle with Spain, determined to appoint a historiographer. Several candidates appeared, Dominicus Bandius of course among them. But the choice of the states fell upon Grotius, though only twenty years of age, and not having offered himself for the post.

His next preferment was that of advocate-general of the fisc for the province of Holland and Zeeland. This was followed by his marriage, in 1608, to Mary van Reigesberg, a lady of family in Zeeland, who proved every way worthy to be the wife of Grotius.

He had already passed from occupation with the classics to studies more immediately connected with his profession. In the winter of 1604 he composed a treatise entitled *De Jure Prædæ*. This treatise he did not publish, and the MS. of it remained unknown to all the biographers of Grotius till 1868, when it was brought to light, and printed at the Hague under the auspices of Professor Fruin. It discovers to us that the principles and the plan of the celebrated *De Jure Belli*, which was not composed till 1625, more than twenty years after, had already been conceived by a youth of twenty-one. In the *De Jure Prædæ* of 1604 we have much more than the germ of the later treatise *De Jure Belli*. Its main principles, and the whole system of thought implied in the later, are anticipated in the earlier work.

On the death of Elias Oldenbarnevelt, Grotius, though only thirty, succeeded him as pensionary of the city of Rotterdam.

In 1613 he formed one of a deputation to the court of

England, for the purpose of adjusting those differences which were already beginning to arise between the two young maritime powers, and which gave rise afterward to a naval struggle disastrous to Holland. He was received by James with every mark of distinction due to his rising reputation. He also cultivated the acquaintance of the Anglican ecclesiastics Overal and Andrewes, and was much in the society of the celebrated scholar Isaac Casaubon, with whom he had been in correspondence by letter for many years.

After Grotius' return from England the exasperation of theological parties in Holland gradually rose to such a pitch that it became clear that an appeal to force would sooner or later be made. This Grotius must have foreseen, but he could hardly have anticipated that he himself would be one of the first and principal victims. To the orthodox Calvinists the word toleration was insupportable. They had the populace on their side. This fact determined the stadtholder, Maurice of Nassau, to support the orthodox party—a party to which he inclined the more readily since Oldenbarnevelt, the grand pensionary, the man whose uprightness and abilities he most dreaded, sided with the Remonstrants.

In 1618 Prince Maurice set out on a sort of pacific campaign, disbanding the civic guards in the various cities of Guelders, Holland, and Zeeland, and occupying the places with troops on whom he could rely. The states of Holland sent a commission, of which Grotius was chairman, to Utrecht, with the view of strengthening the hands of their friends, the Remonstrant party, into that city. Feeble plans were formed, but not carried into effect, for shutting the gates upon the stadtholder, who entered the city with troops on the night of July 26, 1618. There were conferences in which Grotius met Prince Maurice face to face, and taught him that Oldenbarnevelt was not the only man of capacity in the ranks of the Remonstrants whom he had to fear. On the early morning of July 31st, the prince's *coup d'état* against the liberties of Utrecht and of Holland was carried out; the civic guard was disarmed—Grotius and his colleagues saving themselves by a precipitate flight. But it was only a reprieve. The grand pensionary, Oldenbarnevelt, the leader of the Remonstrant party, Grotius, and Hoogeoberz were arrested by order of the stadtholder, brought to trial, and condemned—Oldenbarnevelt to death, and Grotius to imprisonment for life, and confiscation of his property. In June, 1619, he was immured in the fortress of Lovestein near Gorcum. His confinement was rigorous, but after a time his wife obtained permission to share his captivity, on the condition that if she came out, she should not be suffered to return.

Grotius had now before him, at thirty-six, no prospect but that of a lifelong captivity. He did not abandon himself to despair, but sought refuge in returning to the classical pursuits of his youth. The address and ingenuity of Madame Grotius at length devised a mode of escape. It had grown into a custom to send, at stated intervals, the books which he had done with, in a chest, along with his linen to be washed at Gorcum. For many months the warders of the fortress were very exact in searching the chest. But never finding anything but books and linen they grew careless, and began to let the chest pass without opening it. Madame Grotius, perceiving this, prevailed on her husband to allow himself to be shut up in it at the usual time. The two soldiers who carried the chest out complained that it was so heavy "there must be an Arminian in it." "There are, indeed," said Madame Grotius, "Arminian books in it." The chest was carried by canal to Gorcum. When it came there they wanted to put it on a sledge; but the maid telling the boatmen there

were some brittle things in it, it was put on a horse, and so carried to the house of a friend, where it was opened, and Grotius released. He was then dressed up like a mason with hod and trowel, and so conveyed in disguise over the frontier. His first place of refuge was Antwerp, from which he proceeded to Paris, where he arrived in April, 1621. In October he was joined by his wife. There he was presented to the king, Louis XIII., and a pension of 3,000 livres conferred upon him. French pensions were easily granted, all the more so as they were never paid. Grotius was now reduced to great straits. He had not the means of procuring the bare necessities of life. Under these circumstances the *De Jure Belli et Pacis* was composed. The biographers are naturally astonished by the fact that a work of such immense reading, consisting in great part of quotation, could have been written in little more than a year.

He was sent by Sweden on an embassy to France, but in 1645 he demanded and obtained his recall. He was received at Stockholm with all the honors due to him. But neither the climate nor the tone of the court suited him, and he demanded permission to leave. He was driven by a storm on the coast near Dantzic. He got as far as Rostock, where he found himself very ill. He died August 29, 1645.

GROTON, a post town of New London county, Conn., is situated on the Rivers Mystic and Pequonnock, opposite New London, and on the east side of the River Thames at its junction with Long Island sound. Population (1890), 5,511.

GROTTAGLIE, a small city of Italy, in the province of Lecce and circondario of Taranto, about fourteen miles northeast of Taranto.

GROUND, in painting, the coating or preparation put on the surface of the panel, board, or canvas on which a picture is to be painted. Artists attach great importance to the color and texture of the ground, as tending in no small degree to affect the technical quality of the work. The term ground is also applied to different parts of a picture, as the foreground, or portion of the picture on which are placed the figures or objects represented as nearest the spectator; background, the part particularly in portraits, behind or on which it is intended to set off or relieve the head, figure, or group depicted.

GROUND NUT (synonyms, earth nut, pistache de terre, monkey nut, pea nut, Manilla nut), a nut or pod the product of the *Arachis hypogæa*. The plant is an annual of diffuse habit, with hairy stem, with two-paired, abruptly pinnate leaflets. The flowers above ground are sterile, and the pods or legumes are stalked, oblong, cylindrical, about one inch in length, the thin reticulated shell containing one or two irregularly ovoid seeds. After the flower withers, the stalk of the ovary has the peculiarity of elongating and bending down, forcing the young pod under ground, and thus the seeds become matured at some distance below the surface. Hence the specific and vernacular names of the plant. Of the history of this plant much has been written. Monardes in 1596, writes of having seen it largely used about the river Marañon in Brazil, and Marcgraf in 1648, gave a description and figure of it. To M. Jaubert, however, a colorist at Gorée, near Cape Verd, seems to belong the honor of first recommending it as of commercial value. As to its native country the opinions of botanists are divided between Africa and America. It is extensively cultivated in all tropical and subtropical countries, especially in America, Africa, India, the Malayan Archipelago, and China. The plant affects a light sandy soil, and is very prolific, yielding in some instances thirty to thirty-eight bushels of nuts per acre.

GROUNDSEL, is an annual, glabrous or more or less woolly plant of the natural order *Compositæ*, series *Tubulifloræ* and tribe *Senecionideæ*, having a branched succulent stem six to fifteen inches in height; pinnatifid and irregularly and coarsely-toothed leaves; flowers in separate corymbs, with involucre of about twenty equal and several external and smaller bracts, and florets yellow and tubular, rarely ligulate in the marginal row; and ribbed and silky fruit. The plant is indigenous to Europe, whence it has been introduced into all temperate climates. It is a troublesome weed, flowering throughout the year, and propagating itself rapidly by means of its light feathery fruits; it has its use, however, as a food for cage-birds.

GROUSE, a word of uncertain origin, now used generally by ornithologists to include all the "rough-footed" Gallinaceous birds, but in common speech applied almost exclusively, when used alone, to the *Tetrao scoticus* of Linnæus, the *Lagopus scoticus* of modern systematists—more particularly called in English the Red Grouse, but not a century ago almost invariably spoken of as the Moor-fowl or Moor-game.

We must notice the species of the genus *Bonasa*, of which the European *B. sylvestris* is the type. This does not inhabit the British Islands; unfortunately so, for it is perhaps the most delicate game-bird that comes to table. Like its transatlantic congener *B. umbellus*, the Ruffed Grouse or Birch-Partridge (of which there are two other local forms) it is purely a forest-bird. The same may be said of the species of *Canace*, of which two forms are found in America. Nearly allied to these birds is the group known as *Dendragapus*, containing three large and fine forms—all peculiar to North America. Then we have the Sage-cock of the plains of Columbia and California, and the Sharp-tailed Grouse, with its two forms, while finally, the Prairie-hen, also with two local forms, is a bird that in the United States of America possesses considerable economic value, as witness the enormous numbers that are not only consumed, but exported. The American Ruffed Grouse is found in all parts of the United States north of Georgia. In the Eastern States it is called partridge, in the Middle States pheasant, and in the West is known by its proper name. The Pinnated Grouse, or Prairie-hen, has been almost exterminated in the East, but is abundant on the Western prairies. Their meat is dark and inferior to that of the Ruffed Grouse.

GROVE. The almost universal occurrence, at one stage or another in the religious and social development of the races of mankind, of the practice of worshiping by preference under or among trees to which a peculiarly sacred and inviolable character is attached, is a fact too well known to require particular illustration here. Its explanation is to be sought partly in obvious considerations of physical convenience, but even more in certain psychical phenomena which may still be made matters of direct observation and experience. It does not appear to have any necessary connection with tree-worship, another very widely diffused practice, on which, and on its possible connection with ancestor-worship, some suggestive remarks will be found in Spencer's *Principles of Sociology*. It has sometimes been alleged as a characteristic difference between the Semitic and the Aryan races that the former show a tendency to select single trees for sanctuaries, while the latter are generally found worshiping in groves; and this generalization, though liable to many exceptions, is partly borne out at least by the familiar indications to be met with in scripture.

GRUBER, JOHANN GOTTFRIED, a learned German author, was born at Naumburg on the Saale, November

29, 1774. He received his education at the town school of Naumburg and the university of Leipsic, after which he resided successively at Göttingen, Leipsic, Jena and Weimar, occupying himself partly in teaching and partly in various literary enterprises, and enjoying in Weimar the friendship of Herder, Wieland and Goethe. In 1811 he was appointed professor at the university of Wittenberg, and after the division of Saxony he was sent by the senate to Berlin in connection with the negotiations for the union of the university of Wittenberg to that of Halle. After the union was effected he became in 1815 professor of philosophy at Halle.

GRÜN, ANASTASIUS, pseudonym for Anton Alexander, count of Auersperg, who was born April 11, 1806, at Laibach, the capital of the Austrian duchy of Carniola. He received his university education first at Gratz and then at Vienna, where he studied jurisprudence. In 1832 the title of "Imperial Chamberlain" was conferred upon him, and in 1839 he married the daughter of Count Attems. He accepted no official post, and devoted himself chiefly to literary pursuits. When the "March Revolution" broke out in 1848 at Vienna, the count entered the political arena, and represented the district of Laibach at the National Assembly at Frankfort-on-the-Main. After a few months, however, he resigned his seat, and again retired into private life. In 1860, when a fresh impulse was given to political life in Austria, he resumed his activity as a politician, and greatly distinguished himself in the Austrian House of Lords as one of the most intrepid and influential supporters of the cause of liberalism, both in political and religious matters, until his death in 1876. Count Auersperg acquired great fame as a poet, as which he is known under the pseudonym of *Anastasius Grün*.

GRÜN, HANS BALDUNG, a painter of the age of Dürer, was born about 1470 at Gmünd in Swabia, and spent the greater part of his life at Strasburg and Freiburg in Breisgau. The earliest pictures assigned to him are altar-pieces with the monogram H. B. interlaced, and the date of 1496, in the monastery chapel of Lichtenthal, near Baden. Another early work is a portrait of the Emperor Maximilian, drawn in 1501 on a leaf of a sketch-book now in the print-room at Carlsruhe. The *Martyrdom of St. Sebastian* and the *Epiphany* (Berlin Museum), fruits of his labor in 1507, were painted for the market-church of Halle, in Saxony. In 1509 Grün purchased the freedom of the city of Strasburg, and resided there till 1513, when he moved to Freiburg in Breisgau. There he began a series of large compositions, which he finished in 1516, and placed on the high altar of the Freiburg cathedral. He purchased anew the freedom of Strasburg in 1517, resided in that city as his domicile, and died a member of its town council in 1545.

GRUNBERG, or GRÜNEBERG, a town of Prussian Silesia, chief town of a circle in the government district of Liegnitz, is beautifully situated on an affluent of the Oder, and on the railway from Breslau to Stettin by Küstrin, thirty-six miles north-northwest of Glogau. Population (1890), 13,000.

GRUNDTVIG, NIKOLAI FREDERIK SEVERIN, the Danish poet, statesman, and divine, was born at Udby on September 8, 1783, and studied at the free school of Aarhus until he went up to the university of Copenhagen in 1800. At the close of his university life he made Icelandic his special study, until in 1805 he took the position of tutor in a house on the island of Langeland. The next three years were spent in the study of Shakespeare, Schiller, and Fichte. His first work, *On the Songs in the Edda*, attracted no attention. Returning to Copenhagen in 1808, he achieved a greater success with his *Northern Mythology*, and in 1809 with

his *Decline of the Heroic Life in the North*. The boldness of his theological views having provoked opposition, he retired to a country parsonage for a while, but soon returned to pursue a literary career with extraordinary earnestness. From 1812 to 1817 he published five or six works, of which the *Rhyme of Roeskilde* is the most remarkable. From 1816 to 1819 he was editor of a polemical journal entitled *Dannevirke*, and in 1818 to 1822 appeared his Danish paraphrases of Saxo Grammaticus and Snorre. During these years he was preaching to an enthusiastic congregation in Copenhagen, but he accepted in 1821 the country living of Præstø, only to return to the metropolis the year after. His theological career was, however, presently stopped, for, having in 1825 published a brochure, *The Church's Reply*, against the popular Doctor Clausen, he was publicly prosecuted and fined. For seven years he was forbidden to preach, years which he spent in publishing a collection of his theological works, in paying two visits to England, and in studying Anglo-Saxon. In 1832 he obtained permission to preach again, and in 1839 he became priest of the workhouse church of Vartou Hospital, a post he continued to hold until his death in 1872.

GRUNEWALD, MATHIAS. The accounts which are given of this painter, a native of Aschaffenburg, are curiously contradictory. Between 1518 and 1530, according to statements adopted by Waagen and Passavant, he was commissioned by Albert of Brandenburg, elector and archbishop of Mainz, to produce an altarpiece for the collegiate church of St. Maurice and Mary Magdalen at Halle on the Saale; and he acquitted himself of this duty with such cleverness that the prelate in after years caused the picture to be rescued from the Reformers and brought back to Aschaffenburg. A later race of critics, declining to accept the statements of Waagen and Passavant, affirm that there is no documentary evidence to connect Grunewald with the pictures of Halle and Annaberg, and they quote Sandrart and Bernhard Jobin of Strasburg to show that Grunewald is the painter of pictures of a different class.

GRUTER, or GRUYTERE, JAN, a critic and scholar of Dutch parentage by his father's side and English by his mother's, was born at Antwerp, December 3, 1560. To avoid religious persecution his parents while he was still young went to England; and for some years he prosecuted his studies at Cambridge, after which he went to Leyden, where he graduated M. A. In 1586 he was appointed professor of history at Wittenberg, but as he refused to subscribe the *formula concordiæ* he was unable to retain his office. From 1589 to 1592 he taught at Rostock, after which he went to Heidelberg, where in 1602 he was appointed librarian to the university. He died at Heidelberg, September 20, 1627.

GRUYERE, or GRUYERES, is a small pastoral district in the Swiss canton of Freiburg, noted for its cheese. (See FREIBURG, Vol V., p. 2599). The old town of Gruyère, where the counts had their castle, had only 1,097 inhabitants according to the census of 1889, while the neighboring town of Bulle had 2,274.

GRYNÆUS, or GRYNER, JOHANN JAKOB (1540–1617), a learned theologian of the period immediately succeeding the Reformation, was born October 1, 1540, at Bern, where his father Thomas, nephew of Simon Grynæus, was at that time a teacher of theology, was educated at Basel, and in 1559 received an appointment as curate to his father, who had become pastor of Röteln in Baden. In 1563 he proceeded to Tübingen for the purpose of completing his theological studies, and in 1565 he returned to Röteln as successor to his father. Returning to Basel in 1586 as antistes or superintendent of the church there, he exerted for upward of twenty-five years a very considerable influence upon both the

church and the state affairs of that community, and acquired a wide reputation as a skillful theologian of the school of Zwingli. Five years before his death, which occurred August 13, 1617, he had the misfortune to become totally blind, but he continued to preach and lecture to the last.

GRYNÆUS, SIMON, a learned theologian of the Reformation, was born in 1493 at Vehringen; in his fourteenth year was sent to school at Pforzheim, and subsequently studied at the university of Vienna, where he graduated as master of arts and for some time acted as tutor. He next became rector of a school at Ofen (Buda). After an interval spent at Wittenberg with his old school friend Melancthon, he became professor of Greek in the university of Heidelberg in 1525; with the duties of this post he from 1526 combined those also of the Latin chair. In 1529 the friendship of Œcolampadius obtained for him a call to Basel as successor of Erasmus. On his return to Basel in 1531, the year of the death both of Zwingli and of Œcolampadius, he began as theological professor to give exegetical lectures on the New Testament; and in 1534 he was summoned by Duke Ulrich of Würtemberg to assist in the reformation there, and especially in the reorganization of the university of Tübingen. In 1536 he took an active part in the framing of the first Helvetic confession, and also in the conferences held with the purpose of inducing the Swiss to accept the concord of Wittenberg, which had also been drawn up in that year. He was the sole representative of the Swiss churches at the conference of Worms in 1540. His death took place suddenly at Basel on August 1, 1541.

GRYPHIUS, ANDREAS, German poet, was born at Grossglogau, Silesia, on October 11, 1616. His youth fell in the period of the Thirty Years' War, which began in 1618, when he was two years old. After spending five years at school in various towns, he returned to his native place in 1636, and became tutor in the family of Palsgrave George von Schönborn, who crowned him laureate and granted him a patent of nobility. In 1638 he went to the university of Leyden, where he spent six years, at first as a student, afterward as a tutor. Having traveled through France and Italy and lived a year in Strasburg, he went back to Silesia, and in 1650, at the age of thirty-four, was made syndic of the principality of Glogau. This office, the duties of which he faithfully discharged, he held till his death in 1664.

GUACHARO, the Spanish-American name of what English writers have lately taken to calling the OIL-BIRD, a very remarkable bird, first described by Alexander von Humboldt from his own observation and from examples obtained by Bonpland, on the visit of those two travelers, in September, 1799, to a cave near Caripé in the Venezuelan province of Cumaná on the northern coast of South America. A few years later it was discovered, says Latham, to inhabit Trinidad, where it appears to bear the name of *Diablotin*; and much more recently, by the receipt of specimens procured at Sarayacu in Ecuador, Caxamarca in the Peruvian Andes, and Antioquia in New Grenada, its range has been shown to be much greater than had been supposed. The singularity of its structure, its curious habits, and its peculiar economical value have naturally attracted no little attention. About as big as a Crow, its plumage exhibits the blended tints of chocolate-color and gray, barred and penciled with dark brown or black, and spotted in places with white, that prevail in the two families just named. The beak is hard, strong, and deeply notched, the nostrils are prominent, and the gape is furnished with twelve long hairs on each side. The legs and toes are comparatively feeble, but the wings are large. In habits the Guacharo is wholly nocturnal, slumbering by

day in deep and dark caverns which it frequents in vast numbers. Toward evening it arouses itself, and, with croaking and clattering which has been likened to that of castanets, it approaches the exit of its retreat, whence at nightfall it issues in search of its food, which, so far as is known, consists entirely of oily nuts or fruits. The Guacharo is said to build a bowl-like nest of clay, in which it lays from two to four white eggs, with a smooth but lusterless surface, resembling those of some Owls.

GUACO, HUACO, or GUAO, also Vējuco and Bejuco, terms applied to various Central and South American and West Indian plants, in repute for alexipharmic and curative virtues.

GUADALAJARA, a province of Spain, in New Castile, bounded on the north by the provinces of Segovia, Soria, and Saragossa, on the east by Saragossa and Teruel, on the south by Cuenca, and on the west by Madrid. The province is divided into nine administrative districts; but besides Guadalajara, the capital, it has no town of importance except the episcopal see of Sigüenza. The area is 4,869 English square miles; and the estimated population is 208,638.

GUADALAJARA, a city of Spain, capital of the province of the same name, is situated on an elevation not far from the eastern bank of the river Henares, which is here spanned by a stone bridge built on Roman foundations in 1758. It is a station on the Madrid and Saragossa Railway, thirty-eight miles northeast from Madrid, and 2,395 feet above the level of the sea. Population (1890), 7,902.

GUADALAJARA, or in the older spelling, GUADALAXARA, a city of Mexico, the capital of the state of Jalisco, is situated in the Atemarac valley not far from the Rio Grande de Santiago, about 280 miles west-northwest of the city of Mexico. Owing to its considerable elevation above the sea-level, Guadalajara enjoys an excellent climate. Guadalajara is a fairly busy town, with paper-mills and woolen and cotton factories; but all the principal establishments are in the hands of Frenchmen, Germans, or Englishmen. The confectionery of the town is held in high repute, and the Indians of the neighborhood are remarkable for the artistic ability with which they mold figures in clay or rags. The silk embroidery produced in the hospicio is also worthy of mention. Guadalajara was founded in 1531 by Nuñez Guzman, and was made a bishop's see in 1540. The population, which was only 19,500 in 1800, had increased to 46,804 by 1841, and to 100,000 in 1890.

GADELOUPE, an island of the Antilles in the West Indies, belonging to France, is situated sixty-two miles from Martinique. The sailing distance from Brest is 3,750 nautical miles. A narrow channel, called La Rivière Salée, or Salt Stream, with a width of from 100 to 400 feet, separates the island into two portions, Guadeloupe proper or Basse Terre and Grande Terre. The former or western portion measures twenty-eight miles from north to south, and from twelve to fifteen miles from east to west, and its coast-line is estimated at eighty-seven miles. The latter or eastern portion measures twenty-two miles from north to south, and thirty-four from southeast to northwest, and its coast-line is estimated at one hundred and six miles. Basse Terre has a mountainous surface of volcanic origin, attaining its greatest altitude in La Soufrière, a still active volcano, 4,870 feet in height; while Grande Terre is generally flat, with no elevations higher than 115 feet, and consists entirely of calcareous formations.

Along with its dependencies, the smaller islands of Marie Galante, Désirade, and Les Saintes, Guadeloupe forms a separate colonial government.

Administratively the colony is divided into three

arrondissements of Basse Terre, Pointe à Pitre, and Marie Galante. The town of Basse Terre, situated in 15° 59' 30" N. latitude and 66° 24' 31" W. longitude, with a population of 12,000, is the capital, and the seat of the bishopric, which was founded in 1850; and Pointe à Pitre, situated in 16° 14' 12" N. latitude and 66° 11' 41" W. longitude, and containing a population of 16,000, is the principal port. A fine military harbor, popularly known as the Gibraltar of the Antilles, is situated in the group of Les Saintes.

During the twenty-five years from 1848 to 1872 the population of the colony remained almost stationary, the mean being only 132,000. Between 1873 and 1875 there was a notable increase, the mean for these years being 141,000.

GUADIX, a city of Spain, in the province of Granada, situated on an elevated plateau on the northern slope of the Sierra Nevada, and above the left bank of the river Guadix. Population (1890), 10,800.

GUADUAS, a town of Colombia, South America, state of Cundinamarca, is situated in the beautiful valley of the Magdalena, on the road between Bogota and Honda, forty-five miles northwest of the former town, and more than 8,000 feet above sea-level. Population (1890), 8,000.

GUAIAECUM, a genus of trees of the natural order *Zygophyllæ*. The guaiacum or lignum vitæ tree, is a native of the West Indies and the north coast of South America, where it attains a height of twenty to thirty feet. Its branches are numerous, flexuous, and knotted; the leaves opposite and pinnate, with caducous stipules, and entire, glabrous, obovate or oval leaflets, arranged in two or, more rarely, three pairs; the flowers are in axillary cymes, and have five oval pubescent sepals, five distinct pale-blue petals three times the length of the sepals, ten stamens, and a two-celled superior ovary; and the fruit is about three-fourths inch long, with a leathery pericarp, and contains in each of its two cells a single seed. Guaiacum in modern materia medica is used in cutaneous affections, especially in those of a syphilitic origin. It is a powerful diaphoretic, when the patient is confined to a warm chamber inducing profuse sweating, but when the patient is exposed to air acts more upon the urinary organs than upon the excretories of the skin. It is a valuable eliminative in rheumatism, neuralgia and kindred affections, aiding and stimulating the various organs in throwing off the poisonous elements contained in the diseased system.

The *lignum vitæ* of commerce, so named on account of its high repute as a medicinal agent in past times, when also it was known as *lignum sanctum* and *lignum indicum*, *lignum guaycanum*, or simply *guayacan*, is procured from *G. officinale*, and in smaller amount from *G. sanctum*. It is exported in large logs or blocks, generally divested of bark, and presents in transverse section very slightly marked concentric rings of growth, and scarcely any traces of pith; with the aid of a magnifying glass the medullary rays are seen to be equidistant and very numerous. The outer wood, the sapwood or alburnum, is of a pale yellow hue, and devoid of resin; the inner, the heartwood, or duramen, which is by far the larger proportion, is of a dark greenish-brown, contains in its pores 26 per cent. of resin, and has a specific gravity of 1.333, and therefore sinks in water, on which the alburnum floats. Owing to the diagonal and oblique arrangement of the successive layers of its fibers, the wood cannot be split; and on account of its hardness, density, and durability it is much valued for the manufacture of ships' pulleys, rulers, skittle-balls, mallets, and other articles.

GUALDO TADINO, a town of Italy, in the province of Perugia and circondario of Foligno, with a sta-

tion on the line from Ancona to Rome, about fifty-eight miles from the former city. Population (1890), 7,900.

GUALEGUAY, a town of the Argentine republic, department of Entre-Rios, is situated on the Guauguay river, which falls into the Parana, and is navigable up to this point, 120 miles north-northwest of Buenos Ayres. The population is about 10,000.

GUALEGUAYCHÚ, a city of the Argentine republic, department of Entre-Rios, is situated on the Guauguaychú river, which there falls into the Uruguay, 120 miles north of Buenos Ayres. Like Guauguay, it depends for its prosperity chiefly on the sheep and cattle grazed in the neighboring country, and its export trade includes beef, mutton, hides, wool, tallow, and bone manure. The population is about 15,000.

GUAMANGA. See **AYACUCHO**, page 693.

GUAN, a word apparently first introduced into the ornithologist's vocabulary about 1743, by Edwards, who said that a bird he figured was "so called in the West Indies," and the name has hence been generally applied to all the members of the Subfamily *Penelopina*, which are distinguished from the kindred Subfamily *Cracinae* or Curassows by the broad postacetabular area of the pelvis. Like Curassows, Guans are in great measure of arboreal habit. They also readily become tame, but all attempts to domesticate them in the full sense of the word have wholly failed, and the cases in which they have even been induced to breed, and the young have been reared in confinement, are very few. Yet it would seem that Guans and Curassows will interbreed with poultry, and what is more extraordinary is that in Texas the hybrids between the Chiacalacca and the domestic Fowl are asserted to be far superior to ordinary Gamecocks for fighting purposes.

GUANACO, one of the four species of ruminant animals which represent in South America the camels of the East, and which resemble them in the possession of canine teeth in both lower and upper jaws. The Guanaco is the largest species, standing nearly four feet high at the shoulders. It is an elegant creature, with gracefully curved neck and long slender legs; its body is covered with long soft hair of a fawn color above and almost pure white beneath. It is found throughout the southern half of South America, from Peru in the north to Cape Horn in the south, but occurs in greatest abundance in Patagonia. It lives in herds usually of from six to thirty, although these occasionally contain several hundreds, while solitary individuals are sometimes met with. They are exceedingly timid, and therefore wary and difficult of approach; like many other ruminants, however, their curiosity sometimes overcomes their timidity, so as to bring them within range of the hunter's rifle. Their cry is peculiar, being described by Cunningham as something between the bellowing of a deer and the neigh of a horse. The chief enemies of the guanaco; according to the same authority, are the Patagonian Indians and the puma, as it forms the principal food of both. Its flesh is palatable, although wanting in fat, while its skin forms the chief clothing material of the gigantic Patagonians.

GUANAJUATO, or **SANTA FE DE GUANAJUATO**, a city of Mexico, capital of the state of Guanajuato, is situated at a height of 7,200 feet above the sea. Built as it is at the meeting-place of three mountain gorges, and obliged by lack of space to climb the underfalls of the surrounding heights, Guanajuato has a highly picturesque appearance. The Alhondiga de Granaditas, originally a corn magazine, was occupied as a fort in the war of independence, and acquired peculiar interest as the spot where the patriot Hidalgo met his death. Guanajuato, founded in 1554, owed its existence and prosperity to the fact that it is the center of the great

est silver-mining district in the world. Of the individual mines perhaps the most famous is the Valenciana, with a shaft 2,000 feet deep, which is in process of being cleared of the water by which it has long been flooded. The population, which includes a considerable number of foreigners, formerly amounted to 100,000, but is now only 65,000.

GUANCAVELICA. See **HUANCAVELICA**.

GUANO. The deposits of guano, or *huano*, known locally as *huaneras*, are found in characteristic condition and abundance upon a large number of the islands lying off Peru and upon certain parts of the mainland. They occur in Bolivia and to the north of Peru also, but are there generally poorer in quality, if not always less in quantity. For the production and preservation of good guano two conditions are requisite—a rainless or nearly rainless climate and abundance of fish in the waters of the ocean. Both conditions are fulfilled on parts of the Bolivian and Peruvian coasts. The penguins, gannets, divers, cranes, cormorants, flamingoes, and other fish-eating birds thus find ample supplies of food; while their excreta retain their soluble and more valuable constituents. But even Peruvian guano is not exclusively excrementitious, nor wholly the produce of birds. These marine and maritime *huaneras* are the breeding-places, the resorts, and the cemeteries not only of sea-birds, but of many other sea-animals—seals, scallions, etc., frequenting many guano lands and islands, and adding considerably during life and when dead to the deposits. In Peruvian guano, it is true, the evidences of its origin are often obscure, but the somewhat complex sources of this material are well shown in the West-African guano islands. On these Mr. T. R. Eden found (1845) three varieties of guano, the lowest being a crust or rock guano, the next above this being a seal guano, containing much seal-fur, and the uppermost layer being a bird guano, in which there were many mummified bird skins and large quantities of feathers.

The dung of bats, which has been found in large quantities in many caverns, both in Europe and in certain parts of France, the Pyrenees and Italy, in New Zealand, and on the North American continent, has been designated "bat-guano." Further, the term guano, even when employed to describe the marine and maritime deposits previously mentioned, includes a considerable variety of substances very different in chemical composition and in manure value. For the deposits of guano occurring on the rainless or nearly rainless islands and coasts of Peru vary much in the proportion of their constituents—such variation being due less to differences in the origin of the deposits than to subsequent changes. Exposure to the action of the sea and of sea-mist, and the pressure of superincumbent layers, are not without influence on the nature of the guano, very different qualities being found at different depths.

Although allusions to guano occur in the writings of travelers in the seventeenth and eighteenth centuries, the credit of directing the attention of Europe to this curious and useful product is due to Humboldt. In 1804 he brought from the Chincha Islands a specimen which Klaproth and then Fourcroy and Vauquelin analyzed. But it was not until the publication, in 1840, of Liebig's work on chemistry in its relations to agriculture and physiology had demonstrated the importance of artificial manures that a lively interest in this Peruvian fertilizer was awakened. In that year a firm of merchants of Lima sent a large cargo of guano to England; but it was not until 1842 that the regular trade in guano began.

For a long time the group of Peruvian islands known as the Chinchas furnished nearly all the guano that

found its way to Europe. When these deposits, amounting to seven million tons or more, were practically exhausted—only 150,000 tons of deep deposits remaining in 1872,—their further working was stopped except for use in Peru itself. Then the guanos on the Macabi and Huanape islands were exported to Europe, in four years (1870 to 1874) about one million tons having been shipped and about half a million tons remaining in 1875. Since then the Lobos islands, situated about seventy miles north of Macabi, have been worked, as have also the islands of the Ballestas group. Even in 1871 three-fourths of the cargoes of nitrogenous guano were from Huanape, but the amount of nitrogen generally present in them was rather low, often not exceeding 10 per cent. of "potential" ammonia, while the percentage of water was remarkably high—sometimes not less than 25 per cent. The Ballestas guanos of the same year were drier and contained one-third more nitrogen.

In spite of many testings and surveys, the amount of Peruvian guano still remaining to be exported has not been even approximately determined. Not only do contiguous deposits differ much in composition, but it is frequently impossible to ascertain what is guano and what is sand or rock. Sometimes the layers of guano are too thin to be worth removing, in other places they fill up ravines to a much greater depth than would be imagined. An estimate of the total quantity of Peruvian guano remaining in 1877 gave over two million tons available for commerce, but this figure presumably includes all varieties, both nitrogenous and phosphatic. Most of the guano lately and now exported comes from the following groups of islands, or places on the coast—Macabi, Huanape, Ballestas, Punta de Lobos, Pabellon de Pica, and Huanillos, and, since 1877, particularly from the last localities.

The following are among the more obvious characteristics of good Peruvian guano: Although at the present time it is by no means of uniform appearance or of constant composition, yet it may be stated that the best qualities, which most closely resemble the former supplies from the Chinchas, are light in color, do not weigh much more than sixty pounds per bushel, are friable, and do not cohere strongly when pressed between the fingers. Small soft lumps are often observed in good samples; when these are broken a white or pale-colored substance is seen in the center. This lighter-colored matter contains carbonate and other ammoniacal salts; in some adulterated samples its appearance is imitated by means of gypsum. The hard lumps found in guano are of very varying composition, some being highly phosphatic and others highly siliceous. The ash left on burning a good Peruvian guano is white or gray; a red ash generally indicates adulteration with ochre or ferruginous earth. An unusual proportion of water commonly points to damage by sea water or rain, a kind of injury which is the more serious, since it is usually accompanied by a considerable loss of ammonia. If more than a mere trace of chlorine be found in a sample of guano, damage by sea-water may be suspected. Although a good guano commonly contains more than half its weight of organic matter and of other substances driven off by a red heat, yet when a still larger quantity of such volatile matters is found their presence may be, and often is, a sign of admixture with peat.

GUARANA, so called from the Guaranis, an aboriginal American tribe, the plant *Paullinia sorbilis*, Mart., of the natural order *Sapindaceæ* and tribe *Sapindeæ*, indigenous to the north and west of Brazil. It has a smooth, erect stem; large pinnate alternate leaves, composed of five oblong-oval leaflets; inflores-

cence in narrow panicles of short-stalked flowers, having four or five sepals and four petals, eight stamens, and a cylindrical three-celled ovary; and fruit ovoid or pyriform, about as large as a grape.

GUARANTEE, or GUARANTY, in English law, is a promise to be answerable for the debt of another, should he fail to make payment, or generally to be answerable for the performance of any duty by another person. The debt or duty must be owing by another, who is primarily bound, and the guarantor is only liable in the event of his failure of performance.

GUARANTEE ASSOCIATIONS, joint stock companies on the insurance principle, which become security for the integrity of cashiers, travelers, and other employees, on payment of an annual sum calculated either upon the salary or upon the amount for which the association holds itself liable. The advantage of the system is that it obviates the necessity of requesting private friends to become sureties.

GUARATINGUETA, a town of Brazil, in the province of São Paulo, situated near the right bank of the Parahiba, about forty miles northeast of the city of São Paulo. Population (1890), 8,000.

GUARDI, FRANCESCO, a Venetian painter, was a pupil of Canaletto, and followed his style so closely that his pictures are very frequently attributed to his more celebrated master. Guardi sometimes colored Canaletto's designs. He had extraordinary facility, three or four days being enough for producing an entire work. Many of his works are to be found in England; seven in the Louvre; four, of exceptional merit, in the Manfrini Palace, Venice. He lived from 1712 to 1793.

GUARDIAN AND WARD. See INFANT.

GUARIENTO, sometimes incorrectly named Guerriero, was the first Paduan painter who distinguished himself. The only date distinctly known in his career is 1365, when, having already acquired high renown in his native city, he was invited by the Venetian authorities to paint a Paradise, and some incidents of the war of Spoleto, in the great council hall of Venice.

GUARINI, GIOVANNI BATTISTA, the author of the *Pastor Fido*, was born at Ferrara December 10, 1537, just seven years before the birth of Tasso. He was descended from Guarino of Verona (see next article). He inherited considerable wealth, and was able early in life to marry Taddea de' Bendedei, a lady of good birth. In 1567 he entered the service of Alphonso II., duke of Ferrara. When Tasso was condemned to S. Anna, the duke promoted Guarini to the vacant post of court poet. Abandoning this, Guarini retired in 1582 to his ancestral farm, the Villa Guarina, in the lovely country that lies between the Adige and Po, where he gave himself up to the cares of his family, the nursing of his dilapidated fortunes, and the composition of the *Pastor Fido*. In 1585 he was at Turin superintending the first public performance of his drama, whence Alphonso recalled him to Ferrara, and gave him the office of secretary of state. This reconciliation between the poet and his patron did not last long. Guarini moved to Florence, then to Rome, and back again to Florence, where he established himself as the courtier of Ferdinand de' Medici. Guarini finally took refuge in his native Ferrara, which, since the death of Alphonso, had now devolved to the papal see. Here, and at the Villa Guarini, his last years were passed in study, lawsuits and polemical disputes with his contemporary critics, until 1612, when he died at Venice in his seventy-fifth year.

The *Pastor Fido* is a pastoral drama composed not without reminiscences of Tasso's *Aminta*. The scene is laid in Arcadia, where Guarini supposes it to have been the custom to sacrifice a maiden yearly to Diana. But an oracle has declared that when two scions of

divine lineage are united in marriage, and a faithful shepherd has atoned for the ancient error of a faithless woman, this inhuman rite shall cease. The plot turns upon the unexpected fulfilment of this prophecy, contrary to all the schemes which had been devised for bringing it to accomplishment, and in despite of apparent improbabilities of divers kinds. It is extremely elaborate, and, regarded as a piece of cunning mechanism, leaves nothing to be desired. As a play, the *Pastor Fido* disappoints a reader.

GUARINO, or GUARINUS, of Verona, one of the Italian restorers of classical learning, was born in 1370, at Verona, and studied Greek at Constantinople, where for five years he was the pupil of Manuel Chrysoloras. He employed himself as a teacher of Greek, first at Verona and afterward in Venice and Florence; in 1436 he became, through the patronage of Lionel, marquis of Este, professor of Greek at Ferrara; and in 1438 and following years he acted as interpreter for the Greeks at the councils of Ferrara and Florence. He died at Ferrara December 14, 1460, aged ninety.

GUARINO, also known as VARINUS, and surnamed from his birthplace, FAVORINUS, PHAVORINUS, or CAMERS, lexicographer and scholar, was born at Fava, near Camerino, about 1450, studied Greek and Latin at Florence under Politian, and afterward became for a time the pupil of Lascaris. In 1514 Leo X. appointed him bishop of Nocera. In 1517 he published a translation of the *Apophthegmata* of Joannes Stobæus, and, in 1523, appeared his *Etymologicum Magnum*, a compilation which has been frequently reprinted, and which has laid subsequent scholars under great though not always acknowledged obligations. Guarino died in 1537.

GUASTALLA, a town of Italy, in the province of Reggio, at the influx of the Crostolo into the Po, about twenty-four miles northeast of Parma. Population of commune (1890), 10,600.

GUATEMALA, or more rarely GUATIMALA, was formerly a captain-generalcy of Spanish America, which included the fifteen provinces of Chiapas, Suchitepeques, Escuintla, Sonsonate, San Salvador, Vera Paz and Peten, Chiquimula, Honduras, Nicaragua, Costa Rica, Totonicapan, Quesaltenango, Solola, Chimaltenango, and Sacatepeques,—or, in other words, the whole of Central America and part of the present territory of Mexico. The name is now restricted to a small part of the area which constitutes an independent republic.

The area of Guatemala is estimated at 40,000 to 50,000 square miles; the population on January 1, 1888, was 1,394,233.

A large proportion of the country is mountainous. The main or central chain, usually considered a continuation of the Andes, has a mean elevation of about 7,000 feet. In the neighborhood of the capital it bears the name of Sierra de las Nubes; in the northwest it is known as the Sierra Madre.

Guatemala is richly watered, and on the western side a number of the rivers attain a very considerable development. Thus the Motogna, whose principal head stream is called the Rio Grande, has a course of about 250 miles, and is navigable to within ninety miles of the capital, which is situated on the Rio de las Vacas. Of similar importance is the Polochic, which is about 180 miles in length and navigable about twenty miles above the river-port of Telemán.

There are several extensive lakes in Guatemala, of which the Lake of Peten or Laguna de Flores, the Lake of Izabel are the most important.

Except in the marshy lagoons along the Pacific, which are inhabited by groups of fishermen and salt gatherers, the climate of Guatemala is considered a healthy one. The country may be rudely divided into a tropical or

low-lying region, a temperate or middle region, and a cold or elevated region. The tropical region, or *terra calienti*, extends from the level of the sea to an elevation of about 1,300 feet, the temperate, or *tierra templada*, from 1,300 to 4,900 feet, and the cold, or *tierra fria*, from 4,900 to 8,200 feet. Fortunately for the future of Guatemala the *templada* is by far the most extensive.

The fauna of Guatemala is more closely connected with the fauna of the South than with that of North America. There are hardly any animals dangerous to man to be found. Of the cat tribe, it possesses the jaguar, popularly called the tiger, the cougar, popularly called the lion. Several species of monkeys are found in the hot coast regions. Much annoyance is caused to the agriculturist by the little marsupial called the taenacine, or the *Didelphys carinora*, its allied species. The bats are so numerous that villages were sometimes left to their undisputed occupancy. For the bird collector, there is a rich harvest in Guatemala. Snakes are met with in great variety, but only about a fourth of the species are venomous, and even the bite of the rattlesnake is said to be less deadly than in the north. Insect life is very prolific.

Most of the domestic animals of Guatemala—the horse, the ox, the goat, the sheep, the pig, the dog, the rabbit, the common fowl, the peacock, and the pigeon—are of European origin.

The constitution of Guatemala is republican and representative. The council of state consists of twenty-four members, elected by the house of representatives, which consists of fifty-two members, elected by the people. The parliamentary period, and the term of office for the president, who is at the head of the executive, is four years.

The regular army varies in strength according to the exigencies of the times. It did not exceed 2,000 in number in 1888, whereas the militia, well drilled and equipped with the best of modern arms, constitutes a force of 50,000 men.

The income of the government in 1887 was \$6,398,727, the outlay being an equal amount. The budget for 1888 estimates the expenditure at \$4,135,294. On December 31, 1887, the national debt stood as follows:—Home debt, \$7,659,396; foreign debt, \$4,541,460; total, \$12,200,856. The outstanding 5 per cent. loan of 1856, and the 6 per cent. loan of 1869, were converted April 30, 1888, into a 4 per cent. consolidated bonded sterling debt up to July 1, 1891, from which date the interest will be 4½ per cent., but the arrears of interest to be paid only at the rate of 72 per cent.

The national religion is the Roman Catholic, but there is absolute toleration of other creeds. The government pays a regular subvention to the church. Since the rise of the liberal government, great progress has been made in educational matters. The number of schools in the twenty-two departments in 1888 was 1,027, and the number of pupils attending 50,000. They are non-sectarian and compulsory.

In 1888 there were but seventy-three miles of railroad in running order, viz., the line connecting Guatemala with the port of San José, and the one between Retalhulen and the port of Champerico. The line from Puerto Barrios, on the Atlantic, to Guatemala, which latter city it is to connect with the Pacific, is about completed. A contract has been made for a line between Quezaltenango and the port of Ocos. A few miles were in operation between Antigua, Guatemala, and Palin, as well as the branch line between Guatemala and El Guardo Viego.

The mail matter forwarded, in 1887, amounted to 4,523,385 items for home mails. The foreign mail matter

dispatched consisted in the same year of 186,796 ordinary letters and postal cards, 10,683 registered letters, and 442,845 newspapers and packages; together 640,324 items.

The length of wire of the national telegraphic system, in 1887, was 2,032 miles, with 89 offices, employing 259 telegraphers, and representing an investment of \$240,515. The number of messages sent in 1887 was 406,533, 152,757 being government dispatches. The aggregate receipts were \$187,712, and the expenses \$180,302. The number of cablegrams sent from the central office in 1887 was 2,457.

The roads are still in a very poor condition, and but little is done for their improvement. A great proportion of them become little better than mitigated swamps in the rainy season; many of the bridges are of the flimsiest construction and in a pitiable state of repair. Nearly a week in time is taken by ordinary wagons to accomplish the journey from San José to Esquintla, a distance of about ninety miles.

The total imports and exports during the five years, from 1883 to 1887 inclusive, amounted to \$17,816,162 and \$32,484,822, respectively, showing an excess of exports over imports of \$14,667,660.

The duties collected in the five years aggregated \$8,541,960. Among the countries from which the goods were imported in 1887 Great Britain and the United States stand foremost.

The coffee production is the most important item of the foreign trade. It amounted in 1887 to 655,075 quintals, and there were exported, between October 1, 1886, and September 30, 1887, 503,305 quintals. The sugar production in 1887 was 19,266,578, and that of molasses 3,398,001 quintals.

Of late the banana crop has excited much attention on the Atlantic coast. Favorable decrees on the part of the Government, by which land can be readily purchased at a low price (30 to 35 cents an acre) have stimulated this industry. Many Americans have settled in the section referred to, and either bought plantations already producing, or planted new ones. It is estimated that 250,000 banana plants were set out in 1888. The profits from a well-managed banana plantation are estimated at from \$75 to \$100 an acre each year. Bananas will come to perfection in their production in the course of twelve to sixteen months. The average cost per acre, up to the time of production, is \$25. The price paid at the port per bunch is 50 cents during seven months, and 37½ cents during five months in the year. During 1887, 117,514 bunches of this fruit were exported.

During the three years from 1886 to 1888 inclusive, there were imported into the United States from Guatemala goods to the amount of \$6,619,812, while the domestic export from the United States to Guatemala amounted to \$1,964,590.

The rise in coffee and growing property in Guatemala caused more liberal consumption of American goods. There entered the ports of the republic, 1887, 400 steamers and 38 sailing vessels, of an aggregate tonnage of 510,465. Among these vessels 347 sailed under the American flag, 39 under the British and 25 under the German.

In 1888 entire freedom in all commercial transactions between Guatemala and Mexico was established, and a mixed commission is to examine and adjudicate upon all claims made by Guatemalan citizens against Mexico.

The government of Guatemala encourages foreign immigration, but with no great success. While there arrived in 1887, through the ports and across the frontier, 4,346 individuals, 4,061 departed. Among those that arrived 2,824 were Central Americans, 410 Mexi-

cans, 177 from the United States, 118 Frenchmen and 124 Germans.

The treaty of commerce and navigation and consular convention concluded on September 20, 1887, between Guatemala and Germany, was ratified and exchanged at Guatemala on June 22, 1888.

Guatemala began to shake off the Spanish yoke in 1820. Four years later a confederation of the Central American States was effected, slavery abolished and a democratic constitution established. From 1829 till 1851 the young republic was under the rule of San Salvador and Honduras. In the latter year Guatemala recovered her independence under Carrera, who was appointed president till 1856, a dignity which was afterward bestowed upon him for life.

Carrera's successor was General Cerna, who was appointed president in 1865. In the struggle between Spain and Chili, Guatemala maintained a strict neutrality. The liberal party began to rise in influence about 1870, and in May, 1871, Cerna was deposed by Granados. The archbishop of Guatemala and the Jesuits were driven into exile as intriguers in the interest of the clerical party; and General Barrios having been chosen president in 1872, the order was declared extinct, and its property confiscated. In 1876 Barrios invited representatives from the other Central American republics to meet at Guatemala to deliberate on their amalgamation, but the commission separated amid a clash of arms, and war was soon raging between Guatemala, San Salvador and Honduras. Guatemala was enabled by her superior resources to come forth victorious from the conflict.

In 1887 President Barillas established a temporary dictatorship, which act led to a revolution. It had no success, however. The governments of Honduras and San Salvador acted loyally, and thus enabled Guatemala to overthrow the revolution. A number of the rebels were captured, tried by court-martial, and the ring-leaders were shot.

During 1887 and the following years a very healthy tone was observable in business matters in the republic. Agriculturists were jubilant at the abundance of the coffee crop, which, in 1887, yielded about 600,000 quintals. The coffee crops were the main cause of this flourishing condition, and generally a happy state of affairs prevailed.

In August the government decreed that all foreign merchandise, imported by vessels belonging to companies whose vessels made direct voyages, calling at the Pacific ports of the republic, shall receive a drawback of 3 per cent. on the present customs tariffs; but merchandise imported by steamers of lines already established, between San Francisco and Panama, shall only be allowed a reduction of 2 9-10 per cent. of such import duties.

A treaty concluded at Guatemala between the five republics of Central America was officially published on April 15, 1887. The aim of the convention there assembled was "to establish an intimate relationship between them, and, by making the continuance of peace certain, to provide for their future final fusion into one country." The treaty contains thirty-two articles, of which the most important are: That perpetual peace shall exist between the republics, and that in case any difficulties should arise among them, such difficulties shall be submitted to arbitration. All the republics bind themselves to respect the independence of each State, and to prohibit the preparation in any one of armed expeditions against any of the others. All citizens of the different States shall enjoy similar privileges and rights throughout all of them.

Citizens of any one of the Spanish-American republics

may become naturalized after one year's residence, and natives of other countries after three years' residence. All transport by land or sea between the contracting republics of all articles indigenous to or manufactured in them is permitted, and the articles mentioned will be exempted from all customs or taxes. Reciprocal freedom of navigation between the five countries is recognized, as is an equality in port privileges; civil, commercial and criminal suits are placed on an equality in each State. A general system among the five States of coinage, weights and measures, professional and consular rules, and of the penal and civil codes, is provided for. An international congress is to assemble every two years whereat the contracting parties will endeavor peacefully so to frame matters that ultimately the establishment of a Central American confederation may become possible.

GUATEMALA, properly SANTIAGO DE GUATEMALA, or GUATEMALA LE NUEVA, or the New, is the capital of the above republic. It is situated at a height of 5,270 feet above the sea in a fertile meseta or plateau, which is crossed by the valley of the Rio de las Vacas or Cow River. Population 55,000. Like most Spanish-American towns it is laid out in wide and regular streets, and it has extensive suburbs. The houses, though usually of only one story, are solidly and comfortably constructed, and many of them are furnished with large gardens and courts. Among the open spaces the chief are the Plaza Major, which contains the cathedral, erected in 1730, the archiepiscopal palace, the Government buildings, the mint, and other public offices, and the Plaza de la Concordia, recently laid out by the Ministerio de Fomento, and now the favorite resort of the inhabitants. The theater, founded in 1858, which is one of the best of Central America, is situated in the middle of another square. Besides the cathedral, the most important churches are those of San Francisco, La Recolection or church of the La Recollets, La Merces, with a black image of the Virgin, greatly revered by the Indians, and Santo Domingo, the oldest church in the town.

Old Guatemala, frequently called merely Antigua, was destroyed by the Volcan de Agua in 1774, but still remains the chief town of the department of Sacatepequez. It is situated in a beautiful valley in $14^{\circ} 32' 58''$ N. latitude and $90^{\circ} 44' 5''$ W. longitude. Till the fatal outbreak of the volcanic forces it was one of the richest and most beautiful cities of Spanish America, possessing about 100 churches and convents and more than 60,000 inhabitants. The ruins are still almost majestic, and many of the buildings appear as if they had been fortresses. Among those best preserved are the ancient residence of the Spanish governors, now occupied by the administration, and the university building, now the national college. Great damage was done to the place by the earthquake of September, 1874. The population is about 20,000. An older Guatemala was situated at Ciudad Vieja or Almalonga, but seventeen years after it was founded by Alvaredo it was carried away by the great inundation to which the Volcan de Agua owes its name.

GUAVA is the name applied to the fruits of species of *Psidium*, a genus belonging to the natural order *Myrtaceæ*. The species which produces the bulk of the guava fruits of commerce is a small tree from fifteen to twenty feet high, a native of the topical parts of America and the West Indies. It bears short-stalked egg-shaped or oblong leaves, with strongly marked veins, and covered with a soft tomentum or down. The flowers are borne on axillary stalks, and the fruits vary very much in size, shape, and color, numerous forms and varieties being known and cultivated. The variety whose fruits are most valued is that which is sometimes

called the white guava. The fruits are pear-shaped, about the size of a hen's egg, covered with a thin bright yellow or whitish skin filled with soft pulp, also of a light yellowish tinge, and having a pleasant sweet-acid and somewhat aromatic flavor.

GUAYAQUIL, or SANTIAGO DE GUAYAQUIL, the principal seaport of the republic of Ecuador, South America, is situated on the western bank of the Guayaquil river, about twenty miles from its mouth. It has a population of about 23,000.

Santiago de Guayaquil was so called because it was founded on St. James' Day, July 25, 1531. Declared a city by Charles V. on October 6, 1535, it was officially constituted the same year by Balalcazar, and two years later it was restored by Francesco Orellana. In the course of the seventeenth and eighteenth centuries the main facts in its history are the attacks of pirates and disasters by fire. The Dutchman Jacob Clark was the assailant in 1624, the Frenchman David in 1686-7, William Dampierre in 1707, and Clapperton in 1709. As late as 1741 the only defenses were three different forts in the river; but in 1763 the town was made the seat of a government, and a good castle and other fortifications were constructed. The following year a great fire destroyed property to the value of 2,000,000 pesos. In 1837 Guayaquil was made the see of a bishop.

GUAYRA, LA, or LA GUAIRA, a town of Venezuela, in the province of Caracas, about eight miles from the city of Caracas. Population (1890), 50,000.

GUBBIO, a city of Italy, in the province of Umbria, about twenty miles north of Perugia. Population of city, 6,000, of commune, 23,000.

GUBEN, a town of Brandenburg, Prussia, capital of a circle in the government district of Frankfort, is situated at the confluence of the Lubist with the Neisse and at the junction of three different railways, twenty-eight miles south-south-east of Frankfort. Population (1890) 24,000.

GUDGEON, a small fish of the family *Cyprinidae* (see *ICHTHYOLOGY*), with narrow, cylindrical body and with a small barbel at each corner of the mouth.

GUELDERLAND, GELDERLAND, or GUELDERS, formerly a duchy of the empire bounded by Friesland, Westphalia, Brabant, Holland and the Zuydersee. At the beginning of the Christian era the land was held by Batavians and Chamavians, and a few centuries later both Saxons and Franks were added to its population. The Carolingian kings ruled over it by means of a number of counts, among whom those of Hamelan, Teisterbant (Testrebante), and Nimeguen were the most prominent. In 1339 Duke Remald received the hereditary title of duke of Guelderland from the emperor Louis of Bavaria. On February 23, 1473, Charles the Bold became duke of Guelderland. The town of Nimeguen made an heroic effort to oppose the Burgundian accession, but it fell after a lengthened siege. On Charles' death at the battle of Nancy, in 1477, a party in the powerful city of Ghent became anxious to marry Charles of Egmont to their princess, Mary of Burgundy. Before the year was out, however (June 29, 1477), the young man had perished before the walls of Tournay, against which he had led an army of Burgundians and Flemings to recover it from the French. By his marriage with the Princess Mary, Maximilian of Austria considered himself the rightful possessor of Guelderland, and he succeeded by 1482 in quelling all opposition. But ten years later, young Charles of Egmond, the son of Adolphus, set foot once more in his native country. the people soon flocked to his standard; and victorious campaigns proved the capacity of the leader and the enthusiasm of the

soldiers. The fierce contest continued for years, and Charles carried the war into the enemy's territories. In 1507 he pushed into Holland and Brabant, in 1512 appeared before Amsterdam, and in 1514 made capture of Groningen. It was not till 1528 that Charles V. granted him the lifelong occupation of Guelderland, Zutphen, Groningen, Coevorden and Drenthe. On the rise of the Dutch republics most of Guelderland threw off the Spanish yoke. One "quarter" only, that of Roermonde, continued subject, and it received the name of Spanish Guelderland; the other three "quarters," Nimeguen, Zutphen and Arnheim, became Dutch Guelderland, and had their provincial diets twice a year. By the peace of Utrecht, Spanish Guelderland, or the Upper Quarter (Overkwartier), passed to Prussia, including the town of Guelders, but excluding Venloo, which went to the Netherlands, and Roermonde, which went to Austria. By the peace of Paris (1814) the temporary divisions of the French revolutionary period were abolished, and all Guelderland was incorporated with Holland, except the portion which still forms the Prussian circle of Düsseldorf.

GUELDERLAND, the modern province of the Netherlands, has an area of 1932 square miles, and its population in 1890 is given at 490,000. The largest towns are Nimeguen (25,856), Arnheim (41,793), Zutphen (14,513), Apeldoorn (13,851), Ede (10,982), and Rheden (10,536); and there are at least eighteen other communes with more than 5,000 inhabitants.

GUELDER ROSE, so called from Guelderland, its supposed source, termed also Marsh Elder, Rose Elder and Water Elder, is a shrub or small tree of the natural order *Caprifoliaceæ*, and a native of Britain and other parts of Europe, and of Russian Asia. It is common in Ireland, but rare in Scotland. In height it is from six to twelve feet, and it thrives best in moist situations. The leaves are smooth, two to three inches broad, with three to five unequal serrate lobes, and glandular adnate stipules.

GUELDERS, or GELDERN, a town of Rhenish Prussia, in the government district of Düsseldorf, chief and only town of the circle of Geldern, is situated on the Niers, twenty-eight miles northwest of Düsseldorf. Population about 6,000.

GUELFs AND Ghibellines. The names Guelfo and Ghibellino, as applied to the parties in Italy, are Italianized forms of names which at an earlier period designated parties in Germany. Guelfo is the Italian form of Welf, and Ghibellino the Italian form of Waiblingen, a castle of the emperor Conrad. In Germany these names, which are said to have been first used as battle-cries at the battle of Weinsberg in 1140, designated the struggle between the Welfs of Altdorf and the imperial line of the Hohenstaufen. In Italy the names acquired a different meaning, being generally applied respectively to the party of the pope and the party of the emperor. The conflict between the authority of the emperor and the independence of the Italian towns began before the names were used in Germany. These parties first came into prominence in the Lombard league of 1167.

To give a full account of the party quarrels of Guelf and Ghibelline would be to write the history of mediæval Italy. The names began to die out gradually at the beginning of the fifteenth century. Twenty years before, the two parties had united in opposing John of Bohemia. The expedition of Charles IV. into Italy destroyed what shreds still remained of respect for the authority of the empire, and with the extinction of Ghibellinism Guelfism perished also; yet we find the name of Guelf appearing in Milan in 1404, after the death of Gian Galeazzo Visconti, and also in 1447, in the struggle between

Ludovico Sforza and the Duchess Bona of Savoy. In the conquest of Milan by Louis XII., in the beginning of the sixteenth century, we find the supporters of the emperor and Sforza called Ghibellines by Roman writers, and the French party called Guelf.

GUELPH, capital of Wellington county, in the Province of Ontario, is situated on the Speed river and the Grand Trunk railroad, forty-nine miles west of Toronto. The city is built upon a series of hills. It contains six banks, two daily and two weekly papers, besides a monthly publication, nine churches, preparatory and grammar schools, academies, a reading room and library, a number of hotels, public halls, stores, etc. The manufactures embrace woolens, hosiery, flax, sash, doors and blinds, furniture, agricultural implements, flour, oat meal, axles, carriage goods, hardware specialties, etc. Population, 10,500.

GUERCINO. See BÂRBIERI.

GUÉRET, a town of France, chief town of the department of Creuse, is situated on a mountain declivity near the Creuse, about 250 miles south from Paris. Population 5,000.

GUERICKE, OTTO VON, an experimental philosopher, distinguished by his original discoveries of the properties of air, was born at Magdeburg, in Prussian Saxony, November 20, 1602. Having studied law at Leipsic, Helmstadt, and Jena, and mathematics, especially geometry and mechanics, at Leyden, he visited France and England, and, returning to Saxony, took up the profession of engineer-in-chief at Erfurt. In 1627 he was elected alderman in Magdeburg, and in 1646 mayor of that city, and a magistrate of Brandenburg. It was while holding these offices that Guericke devoted his leisure to scientific pursuits, especially in pneumatics. Incited by the discoveries of Galileo, Pascal, and Torricelli, he attempted the creation of a vacuum, a desideratum in science from before Aristotle. He began by experimenting with a pump on water placed in a barrel, but found that when the water was drawn off the air permeated the wood. He then took a globe of copper fitted with pump and stopcock, and discovered that he could pump out air as well as water. Thus Guericke became the inventor of the air-pump (1650). This important discovery was publicly explained before the emperor Ferdinand III. at the imperial diet which assembled at Ratisbon in 1651. Guericke at the same time illustrated in a simple but effective way the force of atmospheric pressure. Placing side by side two hollow hemispheres of copper, he exhausted the air from between them by means of pump and stopcock, and it is recorded that thirty horses, fifteen back to back, were unable to pull them asunder. The apparatus used on this occasion is still preserved in the imperial and royal library at Berlin. Guericke further demonstrated, by the aid of the air-pump, that in a vacuum all bodies fall equally fast, that animals cannot exist therein, and other phenomena. He also invented the air-balance, and the anemoscope, a species of weathercock. The discovery of the property of electro-repulsion is also attributed to him; and he made successful researches in astronomy, predicting the periodicity of the return of comets. In 1681 he gave up office and retired to Ham-burg, where he died May 11, 1686.

GUÉRIN, GEORGES MAURICE DE, a French poet, whose few compositions in prose and verse, published posthumously, showed him to have possessed a true and rare genius, was descended from a noble but poor family, and was born at the château of Le Cayla, in Languedoc, August 4, 1810. He was educated with a view to the church at a religious seminary at Toulouse, and then at the Collège Stanislas, Paris, after which he pro

cured entrance to the society of La Chesnaye, in Brittany, founded by Lamennais, bishop of Rennes. He died July 13, 1839.

The name of EUGÉNIE DE GUÉRIN (1805–1848), the sister of Maurice, cannot be omitted from any notice of him, if only on account of the ties of love which united them; but her *Journals*, published in 1861, English translation 1865, and her *Lettres*, published in 1864, English translation 1865, indicated the possession of gifts of as rare an order as those of her brother, though of a somewhat different kind.

GUÉRIN, JEAN BAPTISTE PAULIN (1783–1855), French painter, belongs to the group who specially represent the Restoration. In 1810 Guérin made his first appearance at the Salon with some portraits, which had a certain success. In 1812 he exhibited *Cain after the murder of Abel*, and, on the return of the Bourbons, was much employed in works of restoration and decoration at Versailles. His *Dead Christ* (Cathedral, Baltimore) obtained a medal in 1817, and this success was followed up by a long series of works, of which the following are the most noteworthy: *Christ on the knees of the Virgin*, 1819; *Anchises and Venus*, 1822; *Ulysses and Minerva*, 1824; *The Holy Family*, 1829, and *Saint Catherine*, 1838. Guérin died January 19, 1855.

GUÉRIN, PIERRE NARCISSE (1774–1833), French painter, was born at Paris, May 13, 1774. The first teacher of Guérin was Nicolas Brenet, whom he left to place himself under Jean Baptiste Regnault, the representative, as contrasted with David, of a distinct form of the classic reaction modified by a tincture of Italian tradition. Guérin became the most distinguished of his pupils, and carried off one of the three "grands prix" offered in 1796, in consequence of the competition not having taken place since 1793. The *pension* was not indeed re-established, but Guérin fulfilled at Paris the conditions imposed upon a *personnaire*, and produced various works, one of which brought him prominently before the public. This work, *Marcus Sextus* (Louvre), exhibited at the Salon of 1799, excited wild enthusiasm, partly due to the subject—a victim of Sulla's proscription returning to Rome to find his wife dead and his house in mourning—in which an allusion was found to the actual situation of the *émigrés*. In 1802 Guérin produced *Phædra and Hippolytus* (Louvre); in 1810, after his return to Paris, he again achieved a great success with *Andromache and Pyrrhus* (Louvre); and in the same year also exhibited *Cephalus and Aurora*, and *Bonaparte and the Rebels of Cairo*. The *Restoration* brought to Guérin fresh honors; he had received from the first consul in 1803 the cross of the legion of honor, and in 1815 Louis XVIII. named him Academician. Baron Guérin died on July 6, 1833, and was buried in the church of La Trinità de' Monti by the side of Claude Lorraine.

GUERNSEY, the second in size of the Channel Islands, thirty miles west of Normandy, and eighty-one miles south of Portsmouth. The total area at low water is estimated at 15,560 acres, or rather more than twenty-four square miles, and of this about 10,000 acres are under cultivation.

For administrative purposes Guernsey is united with Alderney, Sark, Herm, and the adjacent islands in the bailiwick of Guernsey. The island proper is divided into ten parishes. The administration is under the supervision of a lieutenant-governor appointed by the crown; and the parliamentary assembly consists of a bailiff, twelve jurats, a procureur or attorney-general, the beneficed clergy, and twelve delegates elected by the people. Taxation is very light, and the annual revenue amounts to about £10,000. Ecclesiastically the island is a deanery of the Winchester diocese of the

Church of England. The only town of any importance is St. Peter Port on the eastern coast. The population of Guernsey is about 17,000. The island is usually identified with the Sarnia of the latter Roman writers. Its present name would appear to be a corruption of the Norse for Green Isle. For details on its history see CHANNEL ISLANDS.

GUERRAZZI, FRANCESCO DOMENICO, Italian writer and politician, was born at Leghorn, August 12, 1804. He studied law at Pisa, and became acquainted there with Byron, who produced a very strong impression on his lively imagination. In 1827 he published his first novel, *The Battle of Benevento*, a work displaying powerful imagination and strong patriotic feeling. While exiled in 1834 to Portoferraio, on the island of Elba, he wrote *Isabella Orsini* and *The Siege of Florence*, the latter producing great enthusiasm in Italy. In 1844 Guerrazzi was again exiled to Portoferraio. When the revolution broke out in 1848, he was named deputy, then president of the counsel of ministers, and finally, in the beginning of 1849, along with Montanelli and Mazzoni, triumvir and dictator of Tuscany. He had to expiate these few months of power by years of imprisonment and exile. He was banished first to Corsica, where he wrote *Beatrice Cenci*, *The Tower of Nonza*, and *Fides*, and then to Genoa. When the kingdom of Italy was constituted, Guerrazzi was several times sent to parliament as deputy. Toward the end of his life he withdrew to a villa he had on the seashore, near Cecina, not far from Leghorn, where he wrote his novel entitled *The Dying Century*. He died there on September 25, 1873, and was buried in the church of Montenero, near Leghorn.

GUERRERO, formerly TIXTLA, the chief town of the state of Guerrero, Mexico, is situated at an elevation of about 5,000 feet in a narrow and unhealthy valley in the Sierra Madre, twenty-eight miles from the coast and one hundred and fifty miles southwest of the City of Mexico. Population (1890), 10,000.

GUESCLIN. See DU GUESCLIN.

GUEVARA, ANTONIO DE, Spanish chronicler and moralist, was a native of the province of Alava, and passed some of his earlier years at the court of Queen Isabella. In 1528 he entered the Franciscan order, and he afterward accompanied Charles V. during his journeys and residences in Italy and in other parts of Europe. After having held successively the offices of court preacher, court historiographer, bishop of Guadix, and bishop of Mondoñedo, he died in 1545.

In Spanish literature occurs also the name of LUIS VELEZ DE GUEVARA (1570–1644), who is said to have written nearly 400 comedies, of which, however, only a few, and these of little value, have been preserved. This Guevara is chiefly noteworthy as having been the author of a prose romance entitled *El Diable Cojuelo*, which suggested to Le Sage the ideas and materials of his *Diable Boiteux*.

GUGLIELMI. There are several Italian musicians of this name, the most celebrated of them being Pietro, born at Massa Carrara in May, 1727. He received his first musical education from his father, and afterward studied under Durante at the Conservatorio di San Loretto, Naples. His first operatic work was produced at Turin in 1755, and the success was such as falls to the lot of few primary efforts. Guglielmi's reputation was thenceforth established, and soon his fame spread beyond the limits of his own country, so that in 1762 he was called to Dresden to conduct the celebrated opera there. He remained for some years in Germany, where his works met with much success, but the greatest triumphs were reserved for him in England. He went to London in 1772, and stayed there five years, return-

ing to Naples in 1777. He still continued to produce operas at an astounding rate, but was unable to compete successfully with the younger masters of the day. In 1793 he became maestro di capella at St. Peter's Cathedral, and died at Rome, November 19, 1804.

GUIANA, GUYANA, or GUAYANA, an extensive territory in the northeastern part of South America, comprehending in its widest acceptation all the extent of country lying between the rivers Amazon and Orinoco from $3^{\circ} 30'$ S. to $8^{\circ} 40'$ N. latitude, and from $50^{\circ} 22'$ to $58^{\circ} 10'$ W. longitude. It is bounded on the north by the Orinoco and the Atlantic, east by the Atlantic, south by the rivers Negro and Amazon, and west by the Orinoco and the Cassiquiare. Its greatest length from east to west is about 1,200 miles, its greatest breadth, from the mouth of the Orinoco to the confluence of the Rio Negro with the Amazon, about 800 miles; and the estimated area is 690,000 square miles. This vast territory is divided into Brazilian (formerly Portuguese) Guiana, Venezuelan (formerly Spanish) Guiana, and Colonial Guiana. The first two divisions, comprising about five-sixths of the entire region, are claimed by or included in Brazil and Venezuela, respectively; and, stretching eastward from the mouth of the Orinoco toward that of the Amazon, lie the territories of British, Dutch and French Guiana.

Columbus, in 1498, decided that the Orinoco must flow through some vast continent. Vincent Yanez Pinzon, a Spanish navigator, is believed to have first sailed up the Amazon from the coast, Vasco Nuñez landed on the coast of Guiana in 1504, but the discovery is also claimed for Diego de Ordaz, one of the captains of Cortez, in the conquest of Mexico in 1531. Sir Walter Raleigh ascended the Orinoco in 1595 in search of the El Dorado. The first settlement is stated to be that of some Dutch people in 1580 near the river Pomeroon. This possession was contested by the Spaniards, but, in 1613, a colony of Zealanders on the banks of the Essequibo was reported in a flourishing condition. English, and subsequently French, colonization was attempted up the Surinam river. The English returned in 1652 to Paramaribo, and, in 1662, the whole colony was granted by Charles II. to Lord Willoughby. In 1669, however, Dutch Guiana covered all the territory now divided into British, Dutch and French. In 1712 the French attacked the settlement, and exacted a contribution. In 1732 Berbice received a constitution from the states-general, and, in 1763, there was a formidable insurrection of negro slaves who had been introduced from Africa. In 1781 Rodney took possession; and, though the colonies were restored to Holland in 1783, they surrendered again to the British in 1796. The Dutch resumed authority in 1802, and, in 1803, the proper history of British Guiana began.

BRITISH GUIANA, when finally acquired in 1803, and formally ceded in 1814, consisted of the three colonies, Demerara, Essequibo and Berbice, so named after the principal rivers which drain them. These were consolidated into one colony in July, 1831. It is bounded on the north and northeast by the Atlantic, east by Dutch Guiana, from which it is separated by the river Corantyn; south by Brazil, and west by Venezuela. It has an estimated area of 76,000 square miles, but the boundaries were till recently disputed by Venezuela and Brazil. An engagement, however, exists between the British and Venezuelan governments that neither shall occupy territory claimed by both.

DUTCH GUIANA or SURINAM, lies to the east of British Guiana, from which it is separated by the Corantijn or Corantyn in $57^{\circ} 5'$ W. longitude. Its coast extends for upward of 220 miles to the mouth of the Maroni or Marowijne, which forms the boundary to-

ward French Guiana. The Dutch claim possession of 58,530 square miles; but of this extensive area, equal to more than four times that of Holland, not more than 3,230, according to Wolbers, had been explored in 1868, the colonial territory did not comprise more than 640 square miles, and the actual area under cultivation was little over 200. The principal settlements have been made in the lower valley of the Surinam, or between that river and the Saramacca on the west and the Commewijne on the east. At its mouth the Surinam is three miles broad, and at Paramaribo, the capital, about half a mile. Ships of from eighteen to nineteen feet of draught can reach the anchorage in front of the town, which has room for one hundred vessels.

FRENCH GUIANA is bounded on the west by the Maroni or Marowijne, which separates it from Dutch Guiana. Toward the south and east its limits are still uncertain. According to the treaty of Utrecht in 1713 it was to be bounded toward Brazil by the river of St. Vincent Pinzon, but the identification of this river has never been officially determined. The Oyapock is accepted provisionally by both countries, but the French claim that the Arouari is the real St. Vincent Pinzon, and consequently that they have a right to the country for 100 miles further south along the coast. Between the Maroni and the Oyapock the coast line is about 130 miles. The fourteen quarters of the colony are estimated to have an area of 5,052 square miles, but if the frontier be pushed back to the watershed, the whole area of the county could not be less than 53,000 square miles.

GUIBERT, of Nogent, a theological and historical writer, who flourished at the close of the eleventh and the beginning of the twelfth century, was born on Easter Eve, 1053. Dedicated from infancy to the service of God and the Virgin, he received his early education at the Benedictine abbey of Fley (Flaviacum) or St. Germer, in the diocese of Beauvais. He was largely influenced by personal intercourse with Anselm, afterward of Canterbury. Encouraged by his friend, he devoted his energies to Old Testament exegesis, and wrote a commentary upon the narrative of the creation; this was followed by other literary works, both in verse and in prose. In 1104, when he had completed his fiftieth year, he was chosen to be the head of the abbey of Notre Dame de Nogent. He died in 1124.

GUIBERT, or WIBERT (c. 1030-1100), of Ravenna, better known as the antipope Clement III., was born of noble parents in the eleventh century at Parma, where, on attaining the canonical age, he entered the priesthood. During the minority of Henry, Guibert was appointed by the empress Agnes to the chancellorship of the kingdom of Italy; and in this capacity he steadfastly resisted, in the interests of the crown, the innovations of Hildebrand in relation to papal elections. For his services in this he was rewarded with the archbishopric of Ravenna, to which he was consecrated in 1073. By thirty bishops of the imperialist party he was elected pope at Brixen in 1080, an election which was confirmed by the synod which Henry had convened in Rome in 1084, Guibert assuming the title of Clement III. Although it was from his hands that Henry received his coronation, Clement III. met with scant recognition from the clergy, and exercised few papal functions; and his name is not enrolled in any list of popes. He died in September, 1100, and was buried at Ravenna; by the order of Paschalis II. his ashes were afterward disinterred and scattered to the winds.

GUICCIARDINI, FRANCESCO, Italian historian and statesman, was born at Florence in the year 1483. His family was illustrious and noble; and his ancestors for many generations had held the highest posts of

honor in the state. After the usual education of a boy in grammar and elementary classical studies, his father sent him to the universities of Ferrara and Padua, where he stayed until the year 1505. Guicciardini, whose motives were confessedly ambitious, turned his attention to law, and at the age of twenty-three was appointed by the signoria of Florence to read the institutes in public. He was then practicing at the bar, where he won so much distinction that the signoria in 1512 intrusted him with an embassy to the court of Ferdinand the Catholic. In 1515 Leo X. took him into service, and made him governor of Reggio and Modena. In 1521 Parma was added to his rule, and in 1523 he was appointed viceregent of Romagna by Clement VII. These high offices rendered Guicciardini the virtual master of the papal states beyond the Apennines, during a period of great bewilderment and difficulty. In 1526 Clement gave him still higher rank as lieutenant-general of the papal army. While holding this commission, he had the humiliation of witnessing from a distance the sack of Rome and the imprisonment of Clement, without being able to rouse the perfidious duke of Urbino into activity. Clement did not, however, withdraw his confidence, and in 1531 Guicciardini was advanced to the governorship of Bologna, the most important of all the papal lord-lieutenancies. This post he resigned in 1534 on the election of Paul III., preferring to follow the fortunes of the Medicean princes. In 1527 he had been declared a rebel by the signoria on account of his well-known Medicean prejudices; and in 1530, deputed by Clement to punish the citizens after their revolt, he revenged himself with a cruelty and an avarice that were long and bitterly remembered. When, therefore, he returned to inhabit Florence in 1534, he did so as the creature of the dissolute Alessandro de' Medici. Guicciardini pushed his servility so far as to defend this infamous despot at Naples in 1535, before the bar of Charles V., from the accusations brought against him by the Florentine exiles. He won his cause; but in the eyes of all posterity he justified the reproaches of his contemporaries, who describe him as a cruel, venal, grasping seeker after power, eager to support a despotism for the sake of honors, offices and emoluments secured for himself by a bargain with the oppressors of his country. Varchi, Pitti, Segni and Nardi are unanimous upon this point. After the murder of Duke Alessandro in 1537, Guicciardini espoused the cause of Cosimo de' Medici, a boy addicted to field sports, and unused to the game of statecraft. The wily old diplomatist hoped to rule Florence as grand vizier under this inexperienced princeling. He was mistaken, however, in his schemes, for Cosimo displayed the genius of his family for politics, and coldly dismissed his would-be lord-protector. Guicciardini retired in disgrace to his villa, where he spent his last years in the composition of the *Istoria d' Italia*. He died in 1540 without male heirs.

GUIDI, CARLO ALESSANDRO, Italian lyric poet, was born at Pavia in 1650. As chief founder of the well-known Roman Academy called "L'Arcadia," he had a considerable share in the reform of Italian poetry, corrupted at that time by the extravagance and bad taste of the poets Marini and Achillini and their school. His most celebrated song is that entitled *Alla Fortuna* (To Fortune), which certainly is one of the most beautiful pieces of poetry of the seventeenth century. His poems were printed at Parma in 1671, and at Rome in 1704. In 1681 he published at Parma his lyric tragedy *Amalasunta in Italy*, and two pastoral dramas *Daphne* and *Endymion*. Less fortunate was Guidi's poetical version of the six homilies of Pope Clement XI., first as

having been severely criticised by the satirist Settano and next as having proved to be the indirect cause of the author's death. A splendid edition of this version had been printed in 1712, and, the pope being then in San Gandolfo, Guidi went there to present him with a copy. On the way he found out a serious typographical error, which he took so much to heart that he was seized with an apoplectic fit at Frascati and died on the spot.

GUIDICIONI, GIOVANNI, one of the best Italian poets of the first half of the sixteenth century, was born at Lucca in 1480, and died at Macerata in 1541. He occupied a high position, being bishop of Fossombrone and president of Romagna.

GUIDO OF AREZZO, an Italian monk of the eleventh century, has by many been called the father of modern music, and a portrait of him in the refectory of the monastery of Avellana bears the inscription "Beatus Guido, inventor musicæ." Occasional reference to the celebrated musician in the works of his contemporaries are, however, by no means rare, and from these it may be conjectured with all but absolute certainty that Guido was born in the last decade of the tenth century. The place of his birth is, beyond a doubt, Arezzo; for on the title-page of all his works he is styled *Guido Aretinus*, or simply *Aretinus*. At his first appearance in history Guido was a monk in the Benedictine monastery of Pomposa, and it was there that he invented his educational method, by means of which, according to his own statement, a pupil might learn within five months what formerly it would have taken him ten years to acquire. Certain it is that not long after his flight from Pomposa Guido was living at Arezzo, and it was here that, about 1030, he received an invitation to Rome from Pope John XIX. He obeyed the summons, and the pope himself became his first and apparently one of his most proficient pupils. But in spite of his success Guido could not be induced to remain in Rome, the insalubrious air of which seems to have affected his health. In Rome he met again his former superior, the abbot of Pomposa, who seems to have repented of his conduct toward Guido, and to have induced him to return to Pomposa; and here all authentic records of Guido's life cease. We only know that he died on May 17, 1050, as prior of Avellana, a monastery of the Camaldulians. It was he who invented, or at least for the first time systematically used, the lines of the staff, and the intervals or *spatia* between them, and thus fixed the principle of modern notation; and the value of this innovation for educational and general artistic purposes cannot be overrated. There is also little doubt that the names of the first six notes of the scale, *ut, re, mi, fa, sol, la*, still in use among Romance nations, were introduced by Guido, although he seems to have used them in a relative rather than in an absolute sense. It is well known that these words are the first syllables of six lines of a hymn addressed to St. John the Baptist, which may be given here:

<i>Ut</i> queant laxis	<i>resonare</i> fibris
<i>Mira</i> gestorum	<i>famuli</i> tuorum,
<i>Solve</i> polluti	<i>labii</i> reatum,
Sancte Joannes.	

GUIDO RENI, painter, born in 1575; died in 1642. See RENI, page 5025.

GUIDO OF SIENA. The name of this painter is of considerable interest in the history of art, on the ground that, if certain assumptions regarding him could be accepted as true, he would be entitled to share with Cimabue, or rather indeed to supersede him in the honor of having given the first onward impulse to the art of painting. The case stands thus: In the church of S. Domenico in Siena is a large painting of the *Vir-*

gin and Child enthroned, with six angels above, and in the Benedictine convent of the same city is a triangular pinnacle, once a portion of the same composition, representing the Saviour in benediction, with two angels; the entire work was originally a triptych, but is not so now. The principal section of this picture has a rhymed Latin inscription, giving the painter's name as Gu . . . o de Senis, with the date of 1221: the genuineness of the inscription is not, however, free from doubt. The heads of the *Virgin and Child* are indisputably very superior, in natural character and graceful dignity, to anything to be found anterior to Cimabue. The question therefore arises: Are these heads really the work of a man who painted in 1221. The best informed connoisseurship of recent years pronounces in the negative, concluding that the heads are repainted, and are, as they now stand, due to some artist of the fourteenth century, perhaps Ugolino da Siena; thus the claims of Cimabue would remain undisturbed and in their pristine vigor. Beyond this, little is known of Guido de Siena.

GUIENNE, an old French province, whose name until the tenth century was Aquitania, and whose history until it came into the possession of England in 1152 is given under the heading AQUITANIA. It was bounded by the Pyrenees, Languedoc, Auvergne, Angoumois, Saintonge, and the sea of Gascony; and out of it are now formed the departments of Gironde, Dordogne, Lot, Aveyron, Lot-et-Garonne, Tarn, Landes, Gers, Upper Pyrenees, Ariège, and Lower Pyrenees. The chief town was Bordeaux.

GUIGNES, JOSEPH DE, a French Orientalist, born at Pontoise October 19, 1721, became in his fifteenth year a student of Oriental languages, and especially of Chinese, at the Collège Royal under the celebrated Fourmont, whom in 1745 he succeeded at the Royal Library as secretary interpreter of the Eastern languages. A *Mémoire Historique sur l'Origine des Huns et des Turcs*, published by De Guignes in 1748, having brought his name with some prominence before the learned world, he was admitted a member of the Royal Society of London in 1752 and an associate of the French Academy of Inscriptions in 1754. Two years later he gave to the world the first two volumes of his learned and laborious *Histoire Générale des Huns, des Mongoles, des Turcs, et des autres Tartares occidentaux*; and in 1757 he was appointed to succeed Jault in the chair of Syriac at the Collège Royal. The completion of the *Histoire* by the publication of the three remaining volumes in 1758 was followed in 1759 by the publication of a *Mémoire* in which he propounded and endeavored to prove the untenable and absurd theory that the Chinese nation had originated in Egyptian colonization, an opinion to which, in spite of every argument, he to the last obstinately clung. He died at Paris, March 19, 1800.

GUILD. The spirit of association has in all ages induced men to join together for the pleasures of mutual enjoyment or for the attainment of some common purpose for which the support of members was necessary. The idea has taken shape in various ways, influenced by the temperament of race, the policy of governments, the social condition of classes, or the need for a special object. Independently of the organization of peoples, of their constitutions into towns, provinces, and states as units in a system, whether of self-government or of imposed government—independently too of those great associations or brotherhoods, the church, the orders of knighthood, the greater and lesser monastic orders and secret societies—there is a third kind of association upon a basis distinct from these. The public welfare of a community within certain territorial limits is the great object of Govern-

ments, local or imperial; the pursuit of some great moral, religious, or equitable thought, touching the hearts of men in general without regard to nation, was the animating principle of the chivalric and religious orders; but when men began to form themselves into *guilds*, the benefit of each one in his individual and social capacity was concerned, naturally confined within the bounds of neighborhood. A guild was a voluntary association of those living near together who joined for a common purpose, paying contributions, worshiping together, feasting together periodically, helping one another in sickness and poverty, and frequently united for the pursuit of a special object.

The true history of these institutions has been till recently unnoticed, their value and importance, especially in connection with the life of towns and villages, having been but imperfectly investigated or understood. Guilds have, however, been numerous, and their influence most important, in Europe from an early period; they attained their highest prosperity and development in the Teutonic countries, and especially in England during the Middle Ages, and they have been widely spread among the Romance nations.

The essential principle of the guild is the banding together for mutual help, mutual enjoyment, and mutual encouragement in good endeavor. The spirit which directed itself to the inner business and life of each society and its members is the true mark, in some degree, of all bodies, ancient or modern, that can claim the character of guilds. The peace-guild of the north in the tenth century had this character in common with the great trading guild of the thirteenth and fourteenth centuries, or the little social or religious guild of an English country village a century later.

Some German scholars find the origin of the first guilds in the banquets and sacrificial assemblies of the heathen German tribes.

The Romans exercised the right of association from early times; it is attributed to Numa that he encouraged the formation of craft guilds, of which Plutarch enumerates nine; there also existed early religious societies among them. Exercised voluntarily under the republic, this right became crippled under the empire, and the *collegia* were obliged to seek authorization from the state for the narrower objects to which the imperial decrees attempted to limit them. These societies were numerous, not only at Rome, but throughout the empire, especially in the East, in Italy, and in Gaul; a large number were trade corporations, devoted to the interest of their crafts; others were united for good-fellowship, religion, and many especially to provide for burial. In the provinces, besides merchants and others, the highest persons were glad at times to belong to them; those in Rome under the empire appear to have consisted principally of workmen, freedmen, slaves and persons of the humbler classes. All appear to have had the same general features; they chose their own masters and officers, made rules for self-government, paid contributions to a common fund, met and feasted together at stated periods—the freedom of social intercourse being particularly appreciated among the poorer companies. They formed rules for good behavior at table, and admitted women as members; they “affirmed their existence by a common worship,” choosing a patron god.

The Greeks also, in the second and third centuries B.C., had their associations of the same kind, called *Eranoi* or *Thiasoi*, which were numerous at Rhodes, in the islands of the Archipelago, at the Piræus, and in other important places. These societies partook more nearly of the character of the mediæval guilds than did the Roman; the members paid contributions to a gen-

eral fund, aided one another in necessity, provided for funerals, met in assembly to deliberate on their affairs, and celebrated feasts and religious sacrifices in common. Strict rules against disorderly conduct were to be enforced by fine; he who did not pay his yearly quota to the society was excluded, unless he could show good cause of poverty and sickness. Women could be members, and were admitted to the meetings. Some of these societies concerned themselves with religion, others with politics or commerce; in the cause of liberal as opposed to official religion, they appear to have done good service.

In the Middle Ages guilds are recognized as belonging to three of four classes. In the north of Europe the *frith* or *peace-guild* was an important form, widely spread in early times. These were associations for defense, based upon mutual obligations, "sworn communities for the protection of right and the preservation of liberty;" we see traces of them in England from the laws of Ina (seventh century) down to the "Dooms" of London in Athelstan's time (tenth century).

The early English recognized the responsibility of the guild for the actions of its members and their mutual liability,—the fundamental principle of English institutions for keeping the peace; besides this, the rules still exist of Saxon guilds at Abbotsbury, Woodbury, Cambridge, and Exeter, and show by the many points in common with the social guilds of later English growth whence these derived their descent.

At the time of the reformation these guilds were abolished in Protestant countries, under pretense of their being superstitious foundations; in Denmark and North Germany their property was devoted to public service, but in England it was handed over to the king and his courtiers, their guild-halls became poor-houses, their pageants were laid aside. A very few of these societies escaped; St. George's guild at Norwich continued to live on many years.

Wickliffe, in the fourteenth century, had complained of the abuses among the guilds, including those of trades. In 1389 returns were made into chancery of the social and other guilds in England; these, though imperfect, give a valuable body of details, and draw the distinction between the two great classes of social and trade guilds. The trade guilds have in all countries attracted more attention than the rest, on account of their wealth and importance; they are of two orders, *guilds-merchant* and *craft-guilds*. In great cities, such as London and Florence, we do not hear of merchant guilds (Norton); there the separate occupations or crafts early asserted their associating power and independence, and the craft-guilds gradually took a place in the organization of the town government. Many craft-guilds, the heads of which were concerned in the government of the commune, are found in Italy between the ninth and twelfth centuries. But in England and the north of Europe the guilds-merchant during this period, having grown rich and tyrannical, excluded the landless men of the handicrafts; these then uniting among themselves, there arose everywhere by the side of the guilds-merchant the craft-guilds, which gained the upper hand on the continent in the struggle for liberty in the thirteenth and fourteenth centuries. In England these companies usually existed side by side with the old town or merchant-guild; until at length their increasing importance caused the decay of the old guilds, and the adoption of these crafts as part of the constitution of the towns (thirteenth to fifteenth century).

The constitution of the trade-guilds was formed on the model of other guilds; they appointed a master or alderman and other officers, made ordinances, including provisions for religious observance, mutual help and

burial; the town ordinances yet remaining of many places, as of Berwick, Southampton and Worcester, show traces of the trade laws of the old guilds-merchant.

GUILFORD COURT HOUSE, a hamlet in North Carolina, the scene of a battle between Gen. Nathanael Greene (*q.v.*) and Lord Cornwallis, (*q.v.*)

GUILDFORD, a municipal and parliamentary borough and market-town of England, capital of the county of Surrey, is beautifully situated on a gentle acclivity of the northern chalk downs and on the river Wye, crossed there by a bridge of five arches, thirty miles south-southwest of London. Population (1890), 9,800.

GUILLEMOT, the name accepted by nearly all modern authors for a Sea-bird, known as the Frowl, which in former days yearly frequented the cliffs on many parts of the British coasts in countless multitudes. The common Guillemot of both sides of the Atlantic is replaced further northward by a species with a stouter bill, the *U. arra* or *U. bruennichi* of ornithologists, and on the west coast of North America by the *U. californica*. The habits of all these are essentially the same, and the structural resemblance between all of them and the Auks is so great that of late several systematists have relegated them to the genus *Alca*.

GUILLOTINE, the instrument for inflicting capital punishment by decapitation, introduced into France at the period of the Revolution. It consists of two upright posts surmounted by a cross-beam, and grooved so as to guide an oblique-edged knife, the back of which is heavily weighted to make it fall swiftly and with force when the cord by which it is held aloft is let go. Some ascribe the invention of the machine to the Persians; and previous to the period when it obtained notoriety under its present name it had been in use in Scotland, England, and various parts of the Continent. There is still preserved in the Antiquarian Museum of Edinburgh the rude guillotine called "the maiden," by which the Regent Morton was decapitated in 1581. The last persons decapitated by the Scotch "maiden" were the Marquis of Argyll in 1661, and his son the Earl of Argyll in 1685. It would appear that no similar machine was ever in general use in England; but until 1650 there existed in the forest of Hardwick, which was coëxtensive with the parish of Halifax, West Riding, Yorkshire, a mode of trial and execution called the gibbet law, by which a felon convicted of theft within the liberty was sentenced to be decapitated by a machine called the Halifax gibbet. In Germany the machine was in general use during the Middle Ages, under the name of the *Diele*, the *Hobel*, or the *Dolabra*. From the thirteenth century it was used in Italy under the name of *Mannaia*, for the execution of criminals of noble birth. The *Chronique de Jean d'Anton*, first published in 1835, gives minute details of an execution in which it was employed at Genoa in 1507; and it is elaborately described by Père Labat in his *Voyage en Espagne et en Italie* in 1730. It is mentioned by Puy-ségur in his *Mémoires* as in use in the south of France, and he describes the execution by it of Marshal Montmorency at Toulouse in 1632. For about a century it had, however, fallen into general disuse on the Continent; and Doctor Guillotin, who first suggested its use in modern times, is said to have obtained his information regarding it from the description of an execution that took place at Milan in 1702.

Guillotin, who was born at Saintes, May 28, 1738, and elected to the Constituent Assembly in 1789, brought forward on December 1st, of that year, two propositions regarding capital punishment, the second of which was that, "in all cases of capital punishment it shall be of the same kind—that is decapitation—and

It shall be executed by means of a machine." The reasons urged in support of this proposition were that in cases of capital punishment the privilege of execution by decapitation should no longer be confined to the nobles, and that it was desirous to render the process of execution as swift and painless as possible. The debate was brought to a sudden termination in peals of laughter caused by an indiscreet reference of Dr. Guillotin to his machine, but his ideas seem gradually to have leavened the minds of the assembly, and after various debates decapitation was adopted as the method of execution in the penal code which became law on October 6, 1791. At first it was intended that decapitation should be by the sword, but on account of a memorandum by M. Sanson, the executioner, pointing out the expense and certain other inconveniences attending that method, the assembly referred the question to a committee, at whose request Dr. Antoine Louis, secretary to the academy of surgeons, prepared a memorandum on the subject. Without mentioning the name of Guillotin, it recommended the adoption of an instrument similar to that which was formerly suggested by him. The assembly decided in favor of the report, and the contract was offered to the person who usually provided the instruments of justice; but, as his terms were considered exorbitant, an agreement was ultimately come to with a German of the name of Schmidt, who, under the direction of M. Louis, furnished a machine for each of the French departments. After satisfactory experiments had been made with the machine on several dead bodies in the hospital of Bicêtre, it was erected on the Place de Grève for the execution of the highwayman Pelletier on April 25, 1792. While the experiments regarding the machine were carried on, it received the name *Louissette* or *La Petite Louison*, but the mind of the nation seems soon to have reverted to Guillotin, who first suggested its use; and in the *Journal des Révolutions de Paris* for April 28, 1792, it is mentioned as *la guillotine*, a name which it thenceforth bore both popularly and officially. In 1795 the question was much debated as to whether or not death by the guillotine was instantaneous, and in support of the negative side the case of Charlotte Corday was adduced, whose countenance, it is said, blushed as if with indignation when the executioner, holding up the head to the public gaze, struck it with his fist. The connection of the instrument with the horrors of the Revolution has hindered its introduction into other countries, but in 1853 it was adopted under the name of *Fallschwert* or *Falbeil* by the kingdom of Saxony, and it has been subsequently introduced into several other German states. It has often been stated that Dr. Guillotin perished by the instrument which bears his name, but it is beyond question that he survived the Revolution, and died a natural death in 1814.

GUIMARAES, a fortified city of Portugal, province of Minho, government district of Braga, is beautifully situated on the Ave, twelve miles southeast of Braga. Population (1890), 10,000.

GUINEA, the general name applied by Europeans to part of the western coast region of intertropical Africa. Like many other geographical designations, the use of which is controlled neither by natural nor political boundaries, it has been very differently employed by different writers and at different periods. In the widest acceptation of the term, the Guinea coast may be said to extend from 11° north latitude to 16° south latitude, or, in other words, from the neighborhood of Cape Verga to Cape Negro. Southern or Lower Guinea comprises the coasts of Loango, Congo, Angola, and Benguela; and Northern or Upper Guinea comprises part of Senegambia, the Sierra Leone dis-

trict, the Grain Coast, the Ivory Coast, the Gold Coast, the Slave Coast, the Niger Delta, and the Calabar district. The Cameroon mountains may be accepted as the limit of the two divisions, though some writers prefer the river Gambia or the equator. In a narrower and perhaps more common use of the name, Guinea is the coast only from Cape Palmas to the Gaboon.

GUINEA FOWL, a well-known domestic gallinaeous bird, so called from the country whence in modern times it was brought to Europe, the *Meleagris* and *Avis* or *Gallina Numidica* of ancient authors. Little is positively known of the wild stock to which we owe our tame birds, nor can the period of its reintroduction (for there is apparently no evidence of its domestication being continuous from the time of the Romans) be assigned more than roughly to that of the African discoveries of the Portuguese.

GUINEA GRASS (*Panicum maximum*), a grass of the same genus with millet, a native of the West of Africa, but now naturalized, and cultivated in the West Indies and Southern States. Its height in favorable moist situations is from five to ten feet; in dry grounds it is smaller; it has a much-branched and spreading panicle, long flat leaves, and a somewhat creeping root.

GUINEA PEPPER, a name applied to the seeds or dried fruit of several different plants, agreeing in their peppery character, and in being the produce of the West of Africa. The name Malaguetta (Malagheta, Meleguetta, etc.) pepper is generally regarded as equivalent with Guinea pepper, and is a frequent designation of grains of Paradise; but the capsules or dry berries of *Capsicum frutescens* are commonly sold by druggists under the name of Guinea pepper; while both the names Guinea Pepper and Malaguetta pepper have been applied to the dried fruit of *Cubeba clusii*, and to the seeds of *Habzelia* (or *Xylopia*) *athiopica*, a shrub of the natural order *Anonaceæ*.

GUINEA-PIG. See CAVY.

GUINEA-WORM, known also as *Filaria medineensis*, or *F. dracunculus*, a parasitic animal, the body of which is slender, cylindrical, and compressed, and is of the thickness of pack-thread, except at the posterior extremity, where it is somewhat attenuated. It is opaque, of milk-white color; on each side there is a longitudinal line. The length of the worm varies from less than half a foot to three yards. The young animals enter the cuticle and there undergo development, the period of development ranging from two to twenty-four months. They give rise to exceedingly unpleasant and sometimes fatal consequences—particularly if, in their extraction, they are broken. They are thought by some authors to be the fiery serpents which afflicted the Jews in the wilderness.

GUINGAMP, a town of France, capital of an arrondissement in the department of Côtes-du-Nord, is situated in a large and rich valley on the right bank of the Trieux, twenty miles west-northwest of St. Briec. Population (1890), 8,000.

GUIPUZCOA, the smallest and most densely peopled of the three Basque provinces of Spain, is bounded on the north by the Bay of Biscay, on the west by the province of Biscay, on the south and southeast by Alava and Navarre, and on the northeast by the Bidasoa, which separates it from France. Its area is nearly 728 square miles, and its estimated population is 200,000. Situated on the northern slope of the great Cantabrian chain, the province has a great variety of surface in mountain, hill, and valley; and the scenery accordingly is highly picturesque and romantic. The capital of the province is San Sebastian, with a population of 21,355. All the other towns are small, Tolosa alone having a population at all exceeding 5,000; Fuenterrabia no

longer retains its former importance; Mondragon is entirely dependent on the rich iron mines in its vicinity, and Salinas, on the Deva, on its salt works. A small island in the Bidasoa, called La Isla de los Faisanes, or l'Isle de la Conférence, is celebrated as the place where the marriage of the duke of Guienne was arranged between Louis XI. and Henry IV. in 1463, where Francis I. the prisoner of Charles V. was exchanged for his two sons in 1526, and where in 1659 "the peace of the Pyrenees" was concluded between D. Luis de Haro and Cardinal Mazarin.

GUISBOROUGH, or **GISBOROUGH**, a market town of England, North Riding of Yorkshire, is situated in a narrow but fertile valley at the foot of the Cleveland Hills, four miles from the mouth of the Tees and ten miles east-southeast of Middlesborough. Population (1890), 7,000.

GUISCARD. See **ROBERT GUISCARD**.

GUISE, a fortified town of France, department of the Aisne, arrondissement of Vervins, is situated on the left bank of the Oise, thirteen miles northwest of Vervins. Population, 6,500.

GUISE, HOUSE OF. The House of Guise, which in the sixteenth century suddenly rose to an eminence unrivaled in Europe, takes title from the place noticed above. The countship of Guise, a fief under the French crown, was carried in 1333 by its holder, Marie of Blois, as her dower to Rodolf, duke of Lorraine. In 1508 René II., the conqueror of Charles the Bold, divided his territories between his sons Antony, who became duke of Lorraine, and received the Germanic part, and Claude, who had the French fief, including Guise.

Claude of Lorraine thus became founder of a great and well-marked family, which occupied the place that had in the fifteenth century been held by the princes of the lilies. Generation after generation we have a duke and a cardinal side by side: they illustrate with singular fidelity the movements of the period from its Catholic side: the first duke and cardinal belonged to the Renaissance; the second pair threw themselves into the Catholic reaction, and led the resistance to the Reformation in France; the third pair shows the decay of the religious movement, and its transit into political activities, being among the most ambitious statesmen of the later years of the century; while the fourth and last pair feel the breath of Richelieu's absolutism. Claude of Lorraine, born in 1496, succeeded in 1508 to a group of lordships, which by their names testify to the high fortunes of the house. The shield of Claude expresses the pride of the race: we find there not only the Lorraine spread-eagle, the German bird, but also the quarterings of eight sovereign houses, those of the kings of Hungary, Naples, Jerusalem, and Aragon, and of the sovereign lords of Anjou, Guelderland, Flanders, and Bar. This young prince, who claimed so much, and did so much, who both exercised his rights as a foreign prince and took precedence of the proudest in France, attached himself closely to Francis I. He was the most brilliant among the "young men" who displaced the older wisdom of the court of Louis XII. In 1513 he married Antoinette of Bourbon, the duke of Vendôme's daughter and great-aunt of Henry IV.; in 1515 he accompanied Francis to Italy; in 1521 he was on the Spanish frontier, and helped to take Fuenterrabia; in 1522 he opposed the English in the north, covering Paris; next, he defended Champagne from the Germans; and during the captivity of Francis I. at Madrid, he became virtual head of the regency under the queen, Louise of Savoy. In these dark days he crushed the rising of the peasants of Lorraine and Swabia, which threatened all the east of France. After the king's return, Claude was made (in

1527) duke of Guise, and peer, and governor of Champagne. Claude had twelve children, a splendid group of princely youths, who inherited the handsome features and figure of their father, with even greater abilities and a more effective ambition. Francis, the eldest of those who grew up, was born in 1519, and became the second duke; Charles, born in 1524, was the second cardinal of Lorraine, a man as intelligent and depraved as his uncle, and more vigorous and ambitious; Claude, the next, was created duke of Aumale; Louis, archbishop of Sens and cardinal of Guise; René, marquis of Elbeuf. The daughters made brilliant matches: above all, the eldest, Marie, widow of the duke of Longueville, was married in 1538 to James V. of Scotland, and had a stormy career as regent to her daughter, Mary Stuart, queen of Scots.

Claude of Guise died in 1550, leaving his dignities to his son Francis "le grand Guise," who had already won great credit for bravery, and had shown that dashing contempt for all rules of military prudence which gives a captain undying popularity. In 1552, as lieutenant-general in the three bishoprics, he withstood at the siege of Metz the last efforts of Charles V., and saved France from a terrible invasion. Thanks to the jealousy of the Montmorencies, he was sent in 1557 to conquer Naples, and would have added another to the long roll of reputations ruined by Italy, had he not been suddenly recalled to protect his country after the disaster of St. Quentin. With happy boldness, instead of watching the victorious allies, he suddenly attacked and took Calais, ending the English occupation of French soil, and raising his own renown to the highest point. Then, with his brother Charles, second cardinal of Lorraine, he wielded unlimited power throughout the reign of Francis II. Under Charles IX. his influence abated and he withdrew into Alsace. On his return thence in 1562, he was, however unwillingly, for he was not inhumane, the cause of the massacre of Vassy, which began the civil wars. In the first war he won the battle of Dreux (1562), and thence passing southward besieged the Huguenots in Orleans. There, early in 1563, he was assassinated. If he was the noblest of the Guises, his brother Charles, second cardinal of Lorraine was the ablest. In his earlier days the cardinal had shown some sympathy with the Reformers; in later life he vigorously repressed them, and took a leading part in the council of Trent, where he is said to have sketched the first lines of the famous league. Like all early friends of the Jesuits, he did his best for education, and patronized men of letters, while he coerced independence of thought and aimed at introducing the Inquisition. He died in 1574. His younger brother Louis, first cardinal of Guise, "le cardinal des bouteilles," was a grand pluralist, an easy-going personage, whose quiet life was in striking contrast to the feverish energy of his brothers. René, marquis of Elbeuf, another brother, is the stem of the great houses of Elbeuf, Harcourt, and Lislebonne.

Henry of Guise, eldest son of Duke Francis, born in 1550, was with his father at Orleans, and saw his death. The boy therefore began his public life with an inextinguishable hatred against Huguenots, eager to distinguish himself in civil war. With his brother Louis, second cardinal of Guise, he entered into all the intrigues of the succession question, and bitterly opposed Henry of Navarre. He was at Jarnac, and, in the victory of Dormans (1575) over the German invaders, he too won the title of "le Balafré." He soon became the idol of Paris: namely, handsome, and decided, he won all the hearts, and was at once a popular hero. Fortune too favored him by bringing him into contrast with the wretched Henry III., and with his brother the duke of Mayenne. In 1576 he was recognized as head

of the League, supported by Philip II. and the papacy. Ambitious of the crown of France, he worked subtly for it behind the screen of old Cardinal Bourbon's name. In the war of the three Henries (Henry III., Henry of Navarre, Henry of Guise) he again drove the Germans out of France; and, when invited to the capital by the "Sixteen," ruled there unopposed, the "King of Paris." Henry III., whom he had compelled to sign the Edict of Union, found his supremacy intolerable; and just before Christmas (1588), the duke and the cardinal, his brother, were assassinated by the royal orders.

His eldest son, Charles, born in 1571, was arrested at the time of the double murder, but escaped in 1591, and was welcomed with enthusiasm by the Paris mob, which hoped he would wed the infanta of Spain, and with the help of Philip II. secure for himself the throne of France. But the opposition of his uncle Mayenne proved fatal to the scheme. At the end of the struggle, both he and Mayenne submitted to Henry IV., helped him to reduce the nobles in Languedoc, and received the Government of Provence. In Richelieu's days he sided with the queen mother, and was compelled to withdraw in 1631 to Italy, where he died in 1640. By his side also was a cardinal brother, the third of Guise, who ended by abandoning the ecclesiastical state, and marrying one of the mistresses of Henry IV.

Henry, fourth son of Charles, born in 1614, had already succeeded to that family benefice, the archbishopric of Rheims, when the death of his elder brother made him head of the family, and in 1640 fifth duke. He, too, went against the absolutism of the age, and joined the count of Soissons. Condemned to lose his head he fled to Brussels, and took command of the Austrian troops against France—noble traitors to their country being then not uncommon. In 1643, however, after Richelieu's death, he returned to France; but, being chosen their chief by the Neapolitans, at the time of Masaniello's revolt, and dazzled by this opening for his ambition, he betook himself to Naples. There his failure was complete; he was defeated and carried prisoner to Madrid. Delivered thence by the intercession of the Great Condé, he again attempted Naples, and failed again. After this he spent the rest of his romantic, ill-ordered life at the French court, and died in 1664, leaving no issue; his sisters never married, and of all his brothers, one only, Louis, duke of Joyeuse, left a son, born in 1650, who became sixth duke of Guise. He died of small-pox in 1671, leaving an infant son, Francis Joseph, seventh duke, a sickly babe, with whom, four years later, the direct line of the house of Guise expired. The other branches had early died out, saving the family of the seventh son of Claude, first duke, Rene, marquis of Elbeuf; the marquis of Lambesc, who died in 1826, was the last descendant of this branch, and with him the family finally became extinct.

GUITAR, a stringed instrument of Eastern origin. The name no doubt is derived from the Greek, but the instrument itself we owe to the Arabs, who introduced it into Spain. In the sixteenth century it became known in Italy and France, and about 1790 a German instrument maker of the name of Cetto greatly increased its power by adding a sixth string to the five formerly in use. The genuine Spanish guitar was introduced into England after the Peninsula war by Ferdinand Sor, a Spaniard, who was both a composer for and a player on the instrument. About the same time the guitar was very much in fashion on the Continent, and even Paganini cultivated it. But this circumstance was due to the romantic associations rather than to the intrinsic merits of the instrument, and accordingly it soon relapsed into comparative oblivion. It is, however, occasionally em-

ployed in the orchestra and for the accompaniment of simple vocal pieces, and for these purposes it has no doubt its merits. The guitar is a flat-black instrument, the sides of which turn inward. The sounding-board, pierced by a round sound-hole, is generally made of pine, maple or cherry wood being used for the sides and the back. The modern guitar, as already stated, has six strings, while the original *El Aud* of the Arabs had only four, subsequently increased to five.

GUIZOT, FRANÇOIS PIERRE GUILLAUME, historian, orator and statesman, was born at Nîmes on October 4, 1787, of an honorable Protestant family belonging to the *bourgeoisie* of that city. The liberal opinions of his family did not save it from the sanguinary intolerance of the Reign of Terror; and on April 8, 1794, his father perished at Nîmes upon the scaffold. Thenceforth the education of the future minister devolved upon his mother, a woman of slight appearance and of homely manners, but endowed with great strength of character and clearness of judgment. Madame Guizot was a living type of the French Huguenots of the sixteenth century, stern in her principles and her faith, immovable in her convictions and in her sense of duty. In the days of his power, her simple figure, always clad in deep mourning for her martyred husband, was not absent from the splendid circle of his political friends. In the days of his exile in 1848 she followed him to London, and there at a very advanced age closed her life, and was buried at Kensal Green. Driven from Nîmes by the Revolution, Madame Guizot and her son repaired to Geneva, where he received his education. She was a strong liberal, and she even adopted the notion, inculcated in the *Émile*, that every man ought to learn a manual trade or craft. Young Guizot was taught to be a carpenter. Of the progress of his graver studies little is known, for in the work which he entitled *Memoirs of My Own Times*, Guizot omitted all personal details of his earlier life. But his literary attainments must have been precocious and considerable, for when he arrived in Paris in 1805, to pursue his studies in the faculty of laws, he entered, at eighteen, as tutor into the family of M. Stapfer, formerly Swiss minister in France, and he soon began to write in a journal edited by Suard, the *Publiciste*. This connection introduced him to the literary society of Paris. In October, 1809, being then twenty-two, he wrote a review of M. de Chateaubriand's *Martyrs*.

During this period of his life Guizot, entirely devoted to literary pursuits, published a collection of French synonyms (1809), an essay on the fine arts (1811), and a translation of Gibbon with additional notes in 1812. On political subjects a radical antagonism existed between the young constitutional publicist and the spirit of the empire. This did not prevent M. de Fontanes from selecting Guizot for the chair of modern history in Paris in 1812. His first lecture (which is reprinted in his *Memoirs*) was delivered on December 11th of that year. The customary compliment to the all-powerful emperor, he declined to insert in it, in spite of all hints given him by his patrons. Absent from Paris at the moment of the fall of Napoleon in 1814, he was at once selected, on the recommendation of Royer-Collard, to serve the Government of Louis XVIII. in the capacity of secretary-general of the ministry of the interior, under the Abbé de Montesquieu. Upon the return of Napoleon from Elba he immediately resigned, on March 25, 1815 (the statement that he retained office under General Carnot is incorrect), and returned to his literary pursuits. The liberal professions of the emperor during the Hundred Days, though backed by Benjamin Constant, did not for a moment impose on Guizot. He was convinced that Napoleon would never govern us

liberal principles, and that his power could not last. He was equally convinced that a second restoration of the Bourbons was the only mode by which constitutional monarchy could be established in France. He therefore applied himself to promote that object, and repaired to Ghent, where he saw Louis XVIII., and in the name of the liberal party pointed out to his majesty that a frank adoption of a liberal policy could alone secure the duration of the restored monarchy—advice which was ill-received by M. de Blacas and the king's confidential advisers. This visit to Ghent, at a time when France was a prey to a second invasion, was made a subject of bitter reproach to Guizot in after life by his political opponents, as an unpatriotic action. "The Man of Ghent" was one of the terms of insult frequently hurled against him in the days of his power.

On the second restoration Guizot resumed office as secretary-general of the ministry of justice under M. de Marbois, but this minister resigned in 1816, and the young statesman was promoted to the council of state and to the general directorship of the departmental and communal administration of the kingdom. But the reactionary spirit of the chamber of deputies, of the royalist party, and of the successive governments of Louis XVIII., was extremely opposed to the views of Guizot and his friends.

In the eyes of this celebrated party known as the Doctrinaires, the French Revolution had run its course. It had exhausted the popular excesses of the convention and the military despotism of the empire. The victory of the revolution over the arbitrary powers of the crown and the unjust privileges of the aristocracy was complete. Power was transferred to the middle classes of society, and their leaders hoped to establish on the basis of a limited suffrage all the essential rights and liberties of a free people. Their policy was described by the term "juste milieu"—a *via media* between royal authority and popular government. In 1821, when the reaction was at its height after the murder of the Duc de Berri, and the fall of the ministry of Duc Decazes, Guizot's relations to the Government of M. de Villèle became decidedly hostile. He was deprived of all his offices, and in 1825, even his course of lectures was interdicted. During the five succeeding years he played an important part among the leaders of the liberal opposition to the Government of Charles X., although he had not yet entered parliament, and this was also the time of his greatest literary activity. Within this period he published his lectures on representative government; a work on capital punishment for political offenses; a collection of memoirs of the history of England in twenty-six volumes, and of memoirs of the history of France in thirty-one volumes; and a revised translation of Shakespeare. The most remarkable work from his own pen was the first part of his *History of the English Revolution from the Accession of Charles I. to that of Charles II.* The Martignac administration restored Guizot in 1828 to his professor's chair and to the council of state. Then it was that he delivered the celebrated courses of lectures which raised his reputation as an historian to the highest point of fame, and placed him among the best writers of France and of Europe. These lectures formed the basis of his general *History of Civilization in Europe*, and of his *History of Civilization in France*. In January, 1830, Guizot was elected for the first time by the town of Lisieux to the chamber of deputies, and he retained that seat during the whole of his political life, that is, for eighteen years.

Guizot immediately assumed an important position in the representative assembly, and the first speech he

delivered was in defense of the celebrated address of the 221, in answer to the menacing speech from the throne, which was followed by the dissolution of the chamber, and was the precursor of another revolution. On his returning to Paris from Nîmes on July 27th, the fall of Charles X. was already imminent. Guizot was called upon by his friends Casimir Périer, Laffitte, Villemain and Dupin to draw up the protest of the liberal deputies against the royal ordinances of July, while he applied himself with them to control the revolutionary character of the late contest. The chamber of deputies assumed the powers of a convention, and placed the duke of Orleans on the throne. A ministry was formed under M. Laffitte, and although it comprised the great names of Count Molé, Marshal Gérard, Casimir Périer, and the Duc de Broglie, the department of the interior, then the most difficult and important in the state, was allotted to Guizot. In 1831 Casimir Périer formed a more vigorous and compact administration, which was terminated in May, 1832 by his death; the summer of that year was marked by a formidable republican rising in Paris, and it was not till October 11, 1832, that a stable government was formed, in which Marshal Soult was first minister, the Duc de Broglie took the foreign office, Thiers the home department, and Guizot contented himself with the department of public instruction. This ministry, which lasted for nearly four years, was by far the ablest and most comprehensive that ever served Louis Philippe. Guizot, however, was already marked with the stigma of unpopularity by the more advanced liberal party.

The object of the cabinet of October, 1832, was to organize a conservative party, and to carry on a policy of resistance to the republican faction which threatened the existence of the monarchy. The real strength of the ministry lay not in its nominal heads, but in the fact that in this government, and this alone, Guizot and Thiers acted in cordial coöperation. The two great rivals in French parliamentary eloquence followed for a time the same path; but neither of them could submit to the supremacy of the other, and circumstances threw Thiers almost continuously on a course of opposition, while Guizot bore the graver responsibilities of power.

Once again, indeed, in 1839, they were united, but it was in opposition to M. Molé, who had formed an intermediate government, and this coalition between Guizot and the leaders of the left center and the left, Thiers and Odilon Barrot, is justly regarded as one of the chief inconsistencies of his life. Victory was secured at the expense of principle; but none of the three chiefs of that alliance took ministerial office, and Guizot was not sorry to accept the post of ambassador in London, which withdrew him for a time from parliamentary contests. This was in the spring of 1840, and Thiers succeeded shortly afterward to the ministry of foreign affairs.

Guizot was received with marked distinction by the queen and by the society of London. His literary works were highly esteemed; his character was respected, and France was never more worthily represented abroad than by one of her greatest orators. He was known to be well versed in the history and the literature of England, and sincerely attached to the alliance of the two nations and the cause of peace. The warlike policy of Thiers was opposed to his own convictions. The treaty of July 15th was signed without his knowledge and executed in the teeth of his remonstrances. For some weeks Europe seemed to be on the brink of war, until the king put an end to the crisis by refusing his assent to the military preparations of Thiers, and by summoning Guizot from London to form a ministry and to aid

his majesty in what he termed "*ma lutte tenace contre l'anarchie*." Thus began, under dark and adverse circumstances, on October 29, 1840, the important administration in which Guizot remained the master-spirit for nearly eight years. He himself took the office of minister for foreign affairs, to which he added some years later, on the retirement of Marshal Soult, the ostensible rank of prime minister. His first care was the maintenance of peace and the restoration of amicable relations with the other powers of Europe. In his pacific task he was fortunately seconded by the formation of Sir Robert Peel's administration in England, in the autumn of 1841. Between Lord Palmerston and Guizot there existed, unhappily, an incompatibility of character exceedingly dangerous in the foreign ministers of two great and in some respects rival countries. With Lord Palmerston in office, Guizot felt that he had a bitter and active antagonist in every British agent throughout the world; the combative element was strong in his own disposition, and the result was a system of perpetual conflict and counter-intrigues. Lord Palmerston held (as it appears from his own letters) that war between England and France was, sooner or later, inevitable. Guizot held that such a war would be the greatest of all calamities, and certainly never contemplated it. In Lord Aberdeen, the foreign secretary of Sir Robert Peel, Guizot found a friend and an ally perfectly congenial to himself. The opposition in France denounced Guizot's foreign policy as basely subservient to England. He replied in terms of unmeasured contempt, "You may raise the pile of calumny as high as you will." The opposition in England attacked Lord Aberdeen with the same reproaches, but in vain. King Louis Philippe visited Windsor. The queen of England (in 1843) stayed at the Château d'Eu. In 1845 British and French troops fought side by side for the first time in an expedition to the River Plate.

The fall of Sir Robert Peel's government in 1846 changed these intimate relations; and the return of Lord Palmerston to the foreign office led Guizot to believe that he was again exposed to the passionate rivalry of the British cabinet. A friendly understanding had been established at Eu between the two courts with reference to the future marriage of the young queen of Spain. The language of Lord Palmerston and the conduct of Sir Henry Bulwer at Madrid led Guizot to believe that this understanding was broken, and that it was intended to place a Coburg on the throne of Spain. Determined to resist any such intrigue, Guizot and the king plunged headlong into a counter-intrigue, wholly inconsistent with their previous engagements to England, and fatal to the happiness of the queen of Spain. By their influence she was urged into a marriage with a despicable offshoot of the house of Bourbon, and her sister was at the same time married to the youngest son of the French king, in direct violation of Louis Philippe's promises. This transaction, although it was hailed at the time as a triumph of the policy of France, was in truth as fatal to the monarch as it was discreditable to the minister. It was accomplished by a mixture of secrecy and violence. It was defended by subterfuges. By the dispassionate judgment of history it has been universally condemned.

Guizot stuck stubbornly to Louis Philippe. In the afternoon of February 23, 1848, the king summoned his minister from the chamber, which was then sitting, and informed him that the aspect of Paris and the country during the banquet agitation for reform, and the alarm and division of opinion in the royal family, led him to doubt whether he could retain his ministry. That doubt, replied Guizot, is decisive of the question, and instantly resigned, returning to the chamber only to announce that the administration was at an end, and

that Molé had been sent for by the king. Molé failed in the attempt to form a Government, and between midnight and one in the morning Guizot, who had according to his custom retired early to rest, was again sent for to the Tuileries. The king asked his advice. "We are no longer the ministers of your majesty," replied Guizot; "it rests with others to decide on the course to be pursued. But one thing appears to be evident: this street riot must be put down; these barricades must be taken; and for this purpose my opinion is that Marshal Bugeaud should be invested with full power, and ordered to take the necessary military measures, and as your majesty has at this moment no minister, I am ready to draw up and countersign such an order." The marshal, who was present, undertook the task, saying, "I have never been beaten yet, and I shall not begin to-morrow. The barricades shall be carried before dawn." After this display of energy the king hesitated, and soon added: "I ought to tell you that M. Thiers and his friends are in the next room forming a Government!" Upon this Guizot rejoined, "Then it rests with them to do what they think fit," and left the palace. Thiers and Barrot decided to withdraw the troops. The king and Guizot next met at Claremont. This was the most perilous conjuncture of Guizot's life, but he found a safe refuge in Paris for some days in the lodging of a painter whom he had befriended, and shortly afterward effected his escape across the Belgian frontier and thence to London, where he arrived on March 3d.

The society of England, though many persons disapproved of much of his recent policy, received the fallen statesman with as much distinction and respect as they had shown eight years before to the king's ambassador. Sums of money were placed at his disposal, which he declined. A professorship at Oxford was spoken of, which he was unable to accept. His old friends resumed their relations with him. For himself, serene and undisturbed by a catastrophe which had shaken Europe, he immediately collected a few books and resumed the narrative of the British commonwealth, until he brought it down to Monk and Richard Cromwell.

Guizot survived the fall of the monarchy and the government he had served twenty-six years, and died in September, 1874.

GUJARAT. See GUZERAT.

GUJRÁNWÁLA, a British district in the Punjab, with an area (1889) of 2,563 square miles, and population of 600,000. At the first beginning of the Sikh war, the waste plains of Gujránwála were seized by various military adventurers. Charat Singh took possession of the village of Gujránwála, and here his grandson, the great maharaja Ranjit Singh, was born. The Sikh rule, which was elsewhere so disastrous, appears to have been an unmitigated benefit to this district. Ranjit Singh settled large colonies in the various villages, and encouraged cultivation throughout the depopulated plain. In 1847 the district came under British influence, in connection with the regency at Lahore; and in 1849 it was included in the territory annexed after the second Sikh war. Since that time Gujránwála has enjoyed an immunity from the catastrophes of history, with the exception of the events of 1857, which belong to the general annals of India.

GUJRANWALA, the chief town and administrative headquarters of the above district, with a population of 19,301.

GUJRAT, or GOODJRAT, a British district in the Punjab; area (1879), 2,029 square miles; population, 640,000. It is bounded on the northeast by the native state of Kashmir, on the northwest by the river Jhilam, on the west by Shahpur district, and on the southeast by

the rivers Távi and Chenáb. The district of Gujrát comprises a narrow wedge of sub-Himálayan plain country, possessing few natural advantages.

Numerous relics of antiquity stud the surface of Gujrát district. Mounds of ancient construction yield numbers of early coins, and bricks are found whose size and type prove them to belong to the prehistoric period of Hindu architecture. A mound now occupied by the village of Moga or Mong has been identified as the site of Nicæa, the city built by Alexander the Great on the field of his victory over Porus. The Delhi empire established its authority in this district under Bahlol Lodi (1450-1488). A century later it was visited by Akbar, who founded Gujrát as the seat of government. During the decay of the Mughal power, the Ghakkars of Rawal Pindi overran this portion of the Punjab and established themselves in Gujrát about 1741. Meanwhile the Sikh power had been asserting itself in the eastern Punjab, and in 1765 the Ghakkar chief was defeated by Sardar Gújar Sinh, chief of the Bhangi confederacy. On his death, his son succeeded him, but after a few months' warfare, in 1798, he submitted himself as vassal to the máhárájá Ranjít Sinh. In 1846 Gujrát first came under the supervision of British officials. Two years later the district became the theater for the important engagements which decided the event of the second Sikh war. After several bloody battles in which the British were unsuccessful, the Sikh power was irretrievably broken at the engagement which took place at Gujrát, February 22, 1849. The Punjab lay at the feet of the conquerors, and passed by annexation under British rule.

GUJRÁT, the chief town and administrative headquarters of the above district, with a population of 17,391, stands upon an ancient site, formerly occupied, according to tradition, by two successive cities, the second of which is supposed to have been destroyed in 1303, the year of an early Mughal invasion of Delhi.

GULF STREAM. See ATLANTIC.

GULL, the name commonly adopted, to the almost entire exclusion of the old English MEW, for a group of sea-birds widely and commonly known, all belonging to the genus *Larus* of Linnæus, which subsequent systematists have broken up in a very arbitrary and often absurd fashion.

Taking the gulls in their restricted sense, Mr. Howard Saunders, who has lately subjected the group to a rigorous revision (*Proc. Zool. Society*, 1878, pp. 155-211), admits forty-nine species of them, which he places in five genera instead of the many which some prior investigators had sought to establish. Of the genera recognized by him, *Pagophila* and *Rhodostethia* have but one species each, *Rissa* and *Xema* two, while the rest belong to *Larus*. The *Pagophila* is the so-called ivory-gull, *P. eburnea*, names which hardly do justice to the extreme whiteness of its plumage, to which its jet-black legs offer a strong contrast. The young, however, are spotted with black. An inhabitant of the most northern seas, examples, most commonly young birds of the year, find their way in winter to more temperate shores. Its breeding-place has seldom been discovered, and the first of its eggs ever seen by ornithologists was brought home by Sir L. M'Clintock in 1853, from Cape Krabbe. Of the species of *Rissa*, one is the abundant and well-known Kittiwake, *R. tridactyla*, of circumpolar range, breeding, however, also in comparatively low latitudes, as on the coast of Britain, and in winter frequenting southern waters. The other is *R. brevirostris*, limited to the North Pacific, between Alaska and Kamchatka. We have then the genus *Larus*, which ornithologists have hitherto attempted most unsuccessfully to subdivide. It contains the largest

as well as the smallest of gulls. The larger species prey fiercely on other kinds of birds, while the smaller content themselves with a diet of insects and worms. But however diverse be the appearance, structure, or habits of the extremities of the series of species, they are so closely connected by intermediate forms that it is hard to find a gap between them that would justify a generic division. Of the forty-three species of this genus recognized by Mr. Saunders it would be impossible within the limits of this article to attempt to point out the peculiarities. About fifteen belong to Europe and fourteen to North America, of which (excluding stragglers) some five only are common to both countries.

GUM exists in the juices of atmost all plants, but is produced in its purest form by various species of *Acacia*. The name is applied to those exudations from plants, stems, branches, or fruits which are entirely soluble or soften in water, and form with it a thick glutinous liquid or mucilage insoluble in alcohol of sixty per cent., and yield mucic and oxalic acids when treated with nitric acid. In structure gum is quite amorphous, being neither organized like starch nor crystallized like sugar. According to Trecul, the acacias and the *Rosaceæ* yield their gums most abundantly when sickly and in an abnormal state, caused by a fullness of sap in the young tissues, whereby the new cells are softened and finally disorganized; the cavities thus formed fill with liquid, which exudes, dries, and constitutes the gum.

The chief varieties have hitherto been divided as follows:—gum arabic, gum tragacanth, cherry tree gum, gum of Bassora, mucilage.

Gum Arabic may be taken as the type of the gums entirely soluble in water. The principal kinds are distinguished as Turkey Picked Gum, Gedda, Amrad, Gheziri, Senegal, Talca, Australian, Barbary, Cape, and East India (from Bombay and Aden).

The finer varieties are used as an emollient and demulcent in medicine, and in the manufacture of confectionery; the commoner qualities are used as an adhesive paste, for giving luster to crape, silk, etc., in cloth finishing to stiffen the fibers, and in calico-printing. For labels, etc., it is usual to mix sugar or glycerin with it to prevent it from cracking. Physiologically nothing is yet definitely known of gum as a food material. Animals fed thereon soon die of inanition.

Gum senegal, a variety of gum arabic produced by *A. Verek*, occurs in pieces generally rounded, of the size of a pigeon's egg, and of a reddish or yellow color, and specific gravity of 1.436. It gives with water a somewhat stronger mucilage than gum arabic, from which it is distinguished by its clear interior, fewer cracks, and greater toughness. It is imported from the river Gambia, and from Senegal and Bathurst, and is collected in December and March yearly.

Chagual gum, a new variety brought from St. Iago de Chili, resembles gum senegal. About seventy-five per cent. is soluble in water. Its solution is not thickened by borax, and is precipitated by neutral lead acetate; and dilute sulphuric acid converts it into dextroglucose.

Gum Tragacanth, familiarly called gum dragon, exudes from the stem, the lower part especially, of the various species of *Astragalus*, and is collected in Asia Minor, the chief port of shipment being Smyrna. Formerly only what exuded spontaneously was gathered; this was often of a brownish color; but now the flow of the gum is aided by incisions cut near the root, and the product is the fine, white, flaky variety so much valued in commerce. The chief flow of gum takes place during the night, and hot and dry weather is the most favorable for its production.

In color gum tragacanth is of a dull white; it occurs in horny, flexible, and tough, thin, twisted flakes, translucent, and with peculiar wavy lines on the surface. When dried at temperatures under 100° C. it loses about fourteen per cent. of water, and is then easily powdered. Its specific gravity is 1.384.

Gum tragacanth is used in calico-printing as a thickener of colors and mordants; in medicine as a demulcent and vehicle for insoluble powders, and as an excipient in pills; and for setting and mending beetles and other insects. Gum kuteera resembles in appearance gum tragacanth, for which the attempt has occasionally been made to substitute it.

Cherry Tree Gum is an exudation from trees of the genera *Prunus* and *Cerasus*. It occurs in shiny reddish lumps, resembling the commoner kinds of gum arabic. With water, in which it is only partially soluble, it forms a thick mucilage. The soluble portion is arabin.

Gum of Bassora, from Bassora or Bussorah in Asia, is sometimes imported into the London market under the name of the hog tragacanth. It is insipid, crackles between the teeth, occurs in variable-sized pieces, is tough, of a yellowish-white color, and opaque, and has properties similar to gum tragacanth. Very many seeds, roots, etc., when infused in boiling water, yield mucilages which, for the most part, consist of bassorin. Linseed, quince seed and marsh-mallow root yield it in large quantity. (See also GUMBO.)

Gum Resins.—This term is applied to the inspissated milky juices of certain plants, which consist of gum soluble in water, resin and essential oil soluble in alcohol, other vegetable matter and a small amount of mineral matter. They are generally opaque and solid, and often brittle. Their chief uses are in medicine. They include the following:—ammoniacum, asafetida, bdellium, euphorbium, frankincense or olibanum, galbanum, gamboge, myrrh, opoponax, sagapanum and scammony. Several of the resins are often improperly called gums; e.g., benzoin or benjamin, copal, dammar, elemi or animi, kawrie or cawdie or Australian copal, mastic, sandrac and shellac.

GUMBINNEN, the chief town of a government district of the same name in the Prussian province of East Prussia, is situated on the Pissa, an affluent of the Pregel, and on the Eastern Railway, twenty-two miles southwest of Eydtkuhn on the Russian boundaries. Population (1890), 12,000.

GUMBO, or OKRA, an herbaceous hairy annual plant of the natural order *Malvaceæ*, a native of the old world, and naturalized or cultivated in all tropical countries. The leaves are cordate, and three to five lobed, and the flowers yellow, with a crimson center; the ovary is five celled, and the fruit or pod, the *Bendi-Kai* of the Europeans of southern India, is a tapering, ten-angled, loculicidal capsule, four to ten inches in length, except in the dwarf varieties of the plant, and contains numerous oval dark-colored seeds, hairy at the base. Three distinct varieties of the gumbo (*Quiabo* and *Quingombo*) in Brazil have been described by Pacheco. The unripe fruit is eaten either pickled, or prepared like asparagus. It is also an ingredient in various dishes, e.g., the *gumbo* of the southern United States, and the *calalou* of Jamaica; and on account of the large amount of mucilage it contains, it is extensively consumed, both fresh and in the form of the prepared powder, for the thickening of broths and soups. For winter use it is salted, or sliced and dried.

GUM-BOIL, an abscess near the root of a tooth, and discharging itself toward the mucous membrane of the gum; usually superficial, but sometimes more deeply seated in connection with the bone, and causing con-

siderable deformity, with risk of caries or necrosis. Gum-boil should be treated, in the first instance, by simple protection against cold and external injury; but as soon as the presence of matter can be ascertained, it is usually good practice to give vent to it by a free incision.

GUMRI, or as it is now more frequently called ALEXANDROPOL, in honor of the empress Alexandra, a town of Russian Armenia, in the province of Erivan, on the old frontier of the Turkish territory which was formed by the river Arpachai. It is situated 5,268 feet above the sea.

GUM-TREE. See EUCALYPTUS.

GUN-COTTON. In 1838 Pélouze observed that when cotton fabrics or paper were immersed in cold concentrated nitric acid for a short time, the free acid being subsequently removed by washing, these materials became, without important alteration of structure, converted into substances possessed of explosive properties. These were at the time accepted as closely allied to the substances named *xyloidin*, described some years previously by Braconnet, which is obtained by adding water to a solution of starch in cold nitric acid. But subsequent observations established the identity of these explosive products with the explosive cotton, or gun-cotton, of which in 1845 Schönbein announced the discovery, and which he at once proposed as a substitute for gunpowder. Soon after the announcement Böttger and Ott published the method of producing gun-cotton by immersing carded cotton in cold concentrated nitric acid, and subsequently Knop introduced the more advantageous method of treating the cotton wool with a mixture of nitric and sulphuric acids, the latter being used as a dehydrater of the nitric acid, and as an absorbent of the water eliminated by the nitrification of the cellulose or cotton fiber. The composition of gun-cotton was subsequently made the subject of study by Böttger, Pélouze, Péligot, Von Kirchhoff, Sobrero, Béchamp, Porret, Crum, Gladstone, Hadaw, and others, and various formulæ were proposed as representing its composition. The divergence of opinion on this point arose partly from difficulties attending the preparation of uniform products, and the obtaining of trustworthy analytical results with these, and partly from differences of opinion regarding the nature of the chemical explosive body. The products obtained in the earlier investigations differed very much as regards their solubility in mixtures of alcohol and ether, and also with respect to the proportion which their weight bore to that of the cotton wool employed in the experimental operations. Crum was the first to entertain the view that gun-cotton might be regarded as cellulose, in which the two or three atoms of hydrogen are replaced by their equivalent of nitric peroxide. This view was afterward also advanced by Gerhardt, and it received strong support from the researches of Hadow, whose results established the fact that several distinct varieties of pyroxilin could be produced by varying the proportions of nitric and sulphuric acids used, and who definitely established the composition of three of these, the most explosive of which constituted the chief proportion of the product ordinarily obtained as gun-cotton, and had the composition expressed by the name trinitrocellulose. This highest nitro-product in its pure state is insoluble in mixtures of ether and alcohol, whereas the lower products (one of which is the so-called *collodion gun-cotton*, used for photographic purposes (see COLLODION)) differed in regard to their ready solubility in different mixtures of those solvents.

The occurrence of a violent explosion at the works of Messrs. Hall of Faversham, England, not long after they had commenced the manufacture of Schönbein's

gun-cotton wool, followed by a similar casualty in France, led to the abandonment of endeavors to apply this substance, within a brief period of its discovery, except in Austria, where Von Lenk persevered in attempts to devise means for obtaining it in a purer and therefore more staple condition, as well as for bringing its explosive action sufficiently under control to permit of its advantageous employment as a substitute for gunpowder, not only for destructive but also for projectile purposes. The system of manufacture elaborated by Von Lenk consisted in loosely spinning long staple cotton into yarn of various sizes and different compactness; this yarn was converted into gun-cotton by very careful treatment with a large excess of the strongest nitric and sulphuric acids, the product being immersed for many weeks in running water, and then treated with weak alkali; the gun-cotton yarn and thread were either wound more or less compactly on reels or cores, for employment in firearms, or made up into very compact ropes with hollow cores, or into plaits, of lamp-wick form, for employment in shells or mines. The rapidity of explosion of the gun-cotton, *in open air*, or under slight confinement, was thus brought to a great extent under control, but if the resistance opposed to the expansion of the highly heated gases upon the first ignition of the confined gun-cotton developed sufficient pressure to cause them at once to penetrate the inner structure of gun-cotton fiber which composed a charge, a sudden and violent explosion was thus brought about. By the system which Abel has more recently elaborated the fiber after its conversion into gun-cotton is reduced to a very fine state of division; when in this condition the explosive substance is readily converted into sheets or granules, or by compression into homogeneous masses of various degrees of compactness, and of any desired form. In this manner the rapidity of action or explosion of gun-cotton may be reduced to a minimum, though uniformity of action in firearms is still very difficult to attain with it. As the reduction of the gun-cotton fiber to a very fine state of division greatly facilitates the removal by washing, and by alkaline treatment, of the small quantities of unstable impurities already spoken of, the stability of gun-cotton as now manufactured is much greater than that of former products. Compressed gun-cotton needs, like the other forms in which this explosive has been used, very strong confinement for the development of violent explosion, but this can be readily accomplished without any confinement of the substance, through the agency of an initiative detonation.

Compressed gun-cotton may therefore be applied to minning and blasting work, but the most explosive kind producible is inferior in strength to an equal quantity of dynamite. Gun-cotton has the great advantage over dynamite that it does not freeze. An advantage of nitro-glycerine and its preparations is that they remain unaltered under water, and can be used in wet bore-holes with the same facility as in dry holes, consequently dynamite is preferred for submarine work. The expense of producing gun-cotton is from 20 to 25 per cent. higher than dynamite. Gun-cotton in small charges has been used in shot guns, but is only suitable in cases where, as in duck-shooting, a quick-burning powder is desired. For ordinary use it is disqualified by its too great rapidity of explosion and inequality of pressure.

Gun-cotton, if it consists entirely of trinitrocellulose, does not contain sufficient oxygen for the complete oxidation of its carbon; hence more work can be accomplished with a given weight of gun-cotton if a solid oxidizing agent (a nitrate or a chlorate) be incorporated with it in proportion sufficient for complete oxidation.

The compressed preparations (chlorated or nitrated gun-cotton) are as sensitive to detonation as gun-cotton itself, but are less sudden or sharp in their action. These preparations, first manufactured by Abel, were extensively experimented with some years ago, and one of them, prepared with barium nitrate, is now manufactured under the name of *tonite* for blasting purposes. Preparations allied to gun-cotton, in the production of which wood-fiber is used as the starting point, are manufactured for sporting and blasting purposes under the name of Schulze's powder, sawdust powder, and patent gunpowder.

GUNDULITSCH, IVAN, called GIOVANNI GONDOLA, one of the most celebrated Dalmatian poets, was born August 8, 1588, at Ragusa. His early education was superintended by two Jesuits, S. Muzzi and R. Ricasoli, the latter of whom instructed him in philosophy. At the age of twenty Gundulitsch applied himself to the study of jurisprudence; and three years afterward he was intrusted with a high official post in the Ragusan republic. Further particulars of his life are not known; he died December 8, 1638.

GUNDWANA, a form of the name GONDWANA.

GUNMAKING. Under this head falls the manufacture of every description of firearm, from the pistol to the 130-ton gun. The term "small arms" includes sporting and military weapons carried by the shooter; instruments fitted for firing a rapid succession of bullets through one or more barrels from a rest are termed "machine guns;" while the heavier pieces used exclusively in war, are denominated "ordnance."

The date and circumstance of the introduction of portable firearms are involved in obscurity. No doubt many attempts were made and failed previously, but gunpowder does not appear to have come into practical use as a rival to the crossbow for the propulsion of bolts or bullets till the reign of Edward III.; in 1375 mention is made of men armed with "gonnes" at an attack made on a Yorkshire manor-house. The *arquebuse à mèche* was employed in Germany in 1378, and it is therefore probable that some rough weapon was introduced much earlier. The hand-gun was used by both infantry and cavalry; it consisted of a simple iron or brass tube with touch-hole at the top, fixed on a straight stock of wood; when used on foot, the soldier held it firmly by passing the stock under the arm; when used on horseback the stock was shortened to butt against the breast, the barrel resting on a fork secured to the saddle-bow. About the beginning of the reign of Henry VII. the hand-gun was improved by the addition of a cock, which was brought down by a trigger to a pan at the side of the barrel; this cock held a match which ignited a priming in the pan, the priming communicating with the charge by a small hole. The next alteration consisted in the introduction of the wheel-lock, in which a steel wheel, rasped at the edge, protruded into the priming pan. Into the cock was fitted a piece of sulphuret of iron (pyrites) instead of a match; this was kept down to the priming pan by a spring; another spring, when wound up, acted on the wheel, which, when released by the trigger, spun round, rubbing against the pyrites and causing sparks, which set fire to the priming. The wheel-lock was, however, found to be complicated, expensive, and uncertain, so that the match-lock remained in use till the middle of the seventeenth century, when it was displaced by the flint-lock, the earliest form of which, the "snaphaunce," seems to have been invented about the end of the sixteenth century in Germany. In this lock the priming pan was provided with a steel cover, and the cock held a flint; on pulling the trigger the cock fell, the flint struck the steel cover, forcing it back from the pan, evolving at the same time sparks,

which fired the priming. During these developments of the lock the shape of the barrel was gradually changed; in 1621 the length of that of the musket was four feet, and the size of the bore such that twelve bullets weighed one pound. Soon after this the infantry soldier was supplied with a dagger, which fitted into the muzzle and served as a pike. This was improved at Bayonne into the bayonet, and during the latter part of the seventeenth century was still farther improved by the addition of a socket, so that the musket could be fired while the bayonet was fixed ready for use. Little change in firearms took place in the eighteenth century, but in 1807 a Scotch clergyman named Forsyth obtained a patent for priming with fulminating powder, an invention which, though it slumbered till 1834, was destined to cause a complete revolution in the mechanism of firearms. Early in the present reign its value was fully recognized; the magazine of detonating composition and the priming pan used by Mr. Forsyth were improved into the cap and nipple, and the flint-lock was entirely superseded.

For sporting purposes smooth-bored shot-guns and grooved rifles are employed. Both are nearly always double-barreled, and of late years the old muzzle-loaders have been almost entirely supplanted by the many breech-loading systems recently invented, which enable the sportsman to reload with greatly increased rapidity and uniformity, the latter quality being specially important in rifle-shooting. The chief parts composing the arm are the barrel, the lock and the stock. Barrels for sporting arms are made of four different kinds of material—Damascus twist, laminated steel, stub iron and mild cast-steel; besides these, common material is worked up into cheap barrels for exportation. Damascus twist consists of alternate rods of iron and steel placed one upon another; usually six of each kind are thus arranged; they are then forged and thoroughly welded together into a solid bar, which is afterward rolled into rods having a section about three-eighths of an inch square. The rod thus formed is raised to a brightish red heat, and one end of it is placed in a revolving chuck, while the other remains fixed; the turning of the chuck subjects the rod to a severe twisting throughout its whole length, so that at last it acquires the appearance of a screw having a very fine thread. Three of these rods are placed together, the twist of one being in a contrary direction to that of the other two. They are then welded together into a bar; and rolled into a strip about three-fourths of an inch in width. The thickness of this strip depends on the part of the barrel it is intended to form; if for the breech end it is made one-fourth of an inch thick; if for the center, three-sixteenths of an inch; if for the muzzle, one-eighth of an inch. These strips are now ready for coiling, which is performed by raising the strip to a bright red heat, fixing one end of it to a hook projecting from a taper mandril, which is placed in a machine and provided with a handle. On turning the handle the strip is wound round the mandril into a coil about ten inches in length. The coil is then welded by about three inches at a time, till the spirals unite to form a hollow cylinder; it is then hammered on a small mandril till the welding is complete. Three coils welded together end to end form a barrel, to which the three different thicknesses of metal above mentioned give a slightly conical form, approximating to the ultimate shape. About three-fourths of the material is cut away in the making; sixteen pounds of iron are used in the first instance to make a pair of barrels, which weigh only eight pounds when the welding is finished, and only between three and four pounds after boring and grinding. In the manufacture of laminated steel barrels the best quality of steel scrap, after thorough cleaning in a

revolving drum, is mixed with a small proportion of charcoal iron. The mixture is heated in a furnace, and puddled into a ball, which is well worked up under a forge hammer. It is then drawn out under a tilt hammer, and rolled into strips of the required length and thickness, after which it is treated as above described. This material is much esteemed for its hardness and closeness of grain, but it does not possess the elegant marking and appearance of the Damascus twist. Stub iron for barrels was formerly made by putting a quantity of old horse-shoes or stubs into an iron ring, welding them into a solid mass, and then rolling them out to strips of the requisite dimensions. Now a mixture of best wrought scrap, and sometimes steel scrap with stubs is preferred, as giving more hardness and durability to the barrels. A description of the manufacture of cast-steel barrels will be found below, in connection with military rifles. A sham-twist barrel is apt to impose on the purchaser; plain iron is cheaper than twisted iron, and sometimes a thin coil of twist is rolled round a plain inner tube; the whole is then welded together, and has all the appearance of a genuine twisted barrel. Other cheap barrels are made by rolling up strips of iron plate, and welding them together so that each barrel has a weld running down its whole length. As the breech end is thicker than the muzzle end, these barrels are usually made in two lengths.

In the rough state just described the barrels are sent from the forge to the gunmaker, who bores them carefully out to nearly the finished size. He then turns them down at intervals, obtaining correct surfaces by means of inside and outside gauges. The barrels are then "stripped"—that is, turned down the whole length to correspond with the bore. For double guns two barrels are now brazed together, near the muzzle and near the middle. At the breech the barrels are separated by a "steel lump." The axes of the barrels are not quite parallel to each other, but are usually adjusted to cross at about forty yards from the gun.

The best stocks are made of English or Italian walnut, pieces of which reach the gunmaker roughly shaped. They are so cut that the grain shall run lengthways down the stock, and the wood is dried and seasoned to prevent warping. For expensive guns, much attention is paid to beauty of mottling and depth of color. A considerable variety of tools is employed in shaping the stocks and cutting out the beds for locks, processes which, for sporting pieces, are performed by hand. All parts of the lock except the plate are of steel, and reach the gunmaker hammered into shape. The lock plate is of wrought iron, case-hardened. The parts are worked to fit by hand with a number of special tools. Bar locks are those which have a forward action, arranged so that the main spring fits under the bar below the breech end of the barrels; back-action locks have the spring reversed so as to extend down the hand or grip of the stock. The remaining portions of the gun are termed the furniture. They are the heel-plate which covers the butt, the break-off into which the breeching hooks for muzzle-loaders, the trigger plate, the trigger guard, the hammers, the escutcheons, and bolt fastening the barrel to stock, etc. For breech-loaders the action is a most important part of the furniture. The ingenuity of gun-makers has devised an immense variety of actions, and every day sees progress made in strength and simplicity. M. Lefauchaux is entitled to the credit of inventing the modern sporting breech-loader. He first hit on the combination of a pair of barrels open at the breech, playing on a hinge and abutting against a false breech, with a strong-based cartridge-case containing powder and shot ready for firing, and supplied with its own

means of ignition. His early guns were found weak in the fastening of the barrels to the stock, while the mode of igniting the charge was far from perfect. It consisted of a pin passing through the upper part of the cartridge case, the point resting just above a percussion cap placed at the center of the base of the charge; the hammer fell on the head of the pin, driving the point into the cap, and exploding the detonating composition. The gas was found to escape through the pin hole, the extraction was sometimes difficult, and a fall on hard ground would occasionally explode the cartridge; for these reasons the pin system was superseded by the central-fire method, in which the base of the cartridge case was made to hold a small anvil, on to which the cap was driven by a needle or striker passing through the false breech, and receiving the blow of the hammer. In this system the extraction is accomplished automatically, by a piece of steel fitting between the two barrels, and so cut as to clip the rims of both cartridges. To this extractor is attached a rod which runs down between the barrels through a hole in the steel lump as far as the hinge; on opening the joint the rod is driven backward, carrying with it the head and forcing the cartridge cases out of the barrels. Guns on the central-fire system afford no indication of being loaded; extraction and loading are, however, so rapid and easy that every sportsman should invariably withdraw the cartridges on laying down his gun, and reload on again taking the field. Hammers sometimes catch in the brambles, or even in the clothes of the shooter; even the double grip has been known to yield under the effect of the heavy charges now used. The latest guns leave little room for improvement in respect to the action. The hammers are abolished altogether, the striker being a needle in the interior, which is driven against the cap of a central-fire cartridge by a spring when the trigger is pressed; a lever on the top is pushed aside by the thumb, liberating the catch which holds the barrels against the false breech; the barrels then drop from the hinge, and are open for loading. On raising the barrels the action snaps to, and holds them fast; the dropping of the barrels causes an extractor to withdraw the empty cartridge cases. A key at the side regulates the cocking and safety of the lock and striker. The sizes of barrels are designated according to the weight of the solid spherical lead ball which will just fit them, and hence their diameters vary inversely as the cube roots of their numbers.

Barrels were formerly bored cylindrically, but the experiments of gunmakers led them to suppose that better shooting could be obtained by boring to shapes departing in various ways from the simple cylinder. The first modification introduced consisted in enlarging the breech end slightly for about ten inches; subsequently the last few inches at the muzzle were enlarged also, so that the barrel really consisted of two frusta of cones, having the smaller ends together—the position of the narrowest part, like many other matters, was dependent on the fancy of the gunmaker. Of late an attempt has been made to reduce the interior form of the barrel to something like a system, and several kinds of "choke" boring have been introduced. The object to be attained with a shot-gun is to so arrange the charge that the pellets shall be uniformly and thickly distributed round the mean trajectory, and shall also occupy a small space longitudinally.

The manufacture of sporting rifles does not greatly differ from that of shot-guns. Greater strength and weight of barrel are necessary to resist the pressure of the charge, withstand the wedging action of the bullet, and deaden the recoil. The breech-closing action also demands greater strength, but the general arrangements are not different in principle. Rifles for sporting pur-

poses differ from military pieces in being double-barreled, and in requiring accuracy and penetration at short ranges, instead of flat trajectory at very considerable distances. Hence they generally resemble the shot-guns in their action, and fire more powder in proportion to the weight of the bullet than military rifles.

The principle of rifling small arms seems to have been discovered about the beginning of the sixteenth century, but does not appear to have been employed for warlike purposes till the middle of the seventeenth. The difficulty of loading a rifle after firing a few rounds was the great obstacle to its use in the field. Several methods were devised of providing anvils at the bottom of the bore on which a loose ball dropped in could be hammered to fit the grooves, but the principle of expansion by the action of the powder was not brought forward till 1836, when Mr. Greener submitted an egg-shaped bullet, having an opening at one end to receive a conical plug, which, when driven home by the gas, expanded the bullet into the grooves. Shortly after this, the French chasseurs were armed with a rifle throwing an elongated bullet with a hollow-coned base. This was improved by Captain Minié, who added an iron cup to fit into the cone and expand it when forced home by the gas. For this cup a wooden plug was substituted in the three-grooved Enfield rifle in 1855. About this time Sir J. Whitworth brought forward his hexagonal rifling, the guiding idea of which was that every part of the hexagon, except the actual corner, should do its share of the work of giving rotation. He proposed for a barrel thirty-nine inches long, a bore of .45 inch, having one turn in twenty inches. This was intended to be suitable either for an expanding bullet, or for one possessing an easy mechanical fit. The length of the bullet was increased, and the form thus modified suffered much less from the resistance of the air than the previous patterns. The question of breech-loading for military weapons now began to assume importance. About 1841 the Prussians had adopted the needle-gun, a breech-loader on the bolt principle. It was a rough weapon compared with the pieces lately introduced, but a great advance on any known at the time. A conical bullet rested on a thick wad, behind which was packed the powder, the whole being enclosed in strong lubricated paper. The detonator was in the center of the hinder surface of the wad, so that to explode it a needle had to be driven forward from the breech through the base of the cartridge and through the powder. This was accomplished by the action of a spiral spring, when set free by the pulling of the trigger. This arrangement possessed many defects; the gas escaped freely at the breech; the long needles rusted and broke; the springs failed; and the weight of the piece was excessive. Such failings caused the sterling merit of the principle to be underrated, and it was not till 1864 that a committee of officers recommended the introduction of breech-loading arms for general adoption in the British army. The triumph of Prussia in the seven weeks' war with Austria in 1866, at once drew attention to the urgency of the case, and caused all civilized powers to rearm their troops. In England, the Enfield rifles (three-grooved expanding bullet muzzle-loaders) were converted into breech-loaders by the adoption of the Snider method, which consisted in cutting away two inches of the upper part of the breech end of the barrel so as to admit the cartridge, which was pushed forward into a chamber formed by enlarging the end of the bore. A block, opening on a hinge, was then shut down to fill up the space behind, forming a false breech against which the base of the cartridge abutted. The striker consisted of a needle passing through this breech block; when struck from behind by the hammer it was driven against a cap in the

base of the cartridge, exploding the charge. Proposals were then invited, and a number of inventions submitted, the result of which was that in 1869 the combination of the Martini breech action with the Henry barrel was decided on for future manufacture, and the whole of the British army is now provided with these weapons. The general principles of manufacture are the same for all kinds of military breech-loading rifles.

The Vetterli gun used by the Italians and Swiss, is a repeater or magazine gun. It contains a supply of eleven cartridges, arranged in a tube running under the barrel, and forced by a spring in to the loading position one by one, as the previously fired empty one is extracted. The arm can thus fire twelve rounds with great rapidity without reloading; it can also be used as an ordinary breech-loader, a fresh cartridge being inserted at every round, and the magazine kept constantly full. This is no doubt a great advantage under certain circumstances, but entails grave inconveniences. Thus the Vetterli gun, with magazine full weighs just half as much again as the Martini-Henry, and gives less energy to its bullet at the muzzle in the proportion of five to eight, a proportion which increases to the disadvantage of the magazine gun as the range increases. Still, for a *mêlée*, and at short ranges, the Vetterli is no doubt a very formidable piece.

These considerations have led the Government of the United States to make trials of a number of magazine guns, of which one is the Hotchkiss. The magazine is contained in the stock, and holds five cartridges, a sixth being in the chamber ready for firing. These cartridges are the same as those used for government Springfield rifles; they are pushed successively into the loading position by a spiral spring till the magazine is empty, or a fresh cartridge can be inserted after each round as in an ordinary breech-loader. The action of bringing the knob-handle upright and withdrawing the bolt extracts and throws out the emptied cartridge to the side; the next cartridge is then pushed up into the loading position by the spring, and is forced into the barrel when the handle presses the bolt forward; this action also cocks the piece, but the striker cannot reach the cartridge till the knob-handle is turned down, and the bolt thus locked in position. The weight of the piece fully loaded is nine and a half pounds.

Of all the military rifles adopted by the various governments, the Springfield (breech-loader, United States), the Berdan (breech-loader, Russia), and the Lee (magazine gun), are the most powerful; and the test the Martini-Henry underwent in Turkey, where a cheap gun of this pattern was supplied on contract by an American firm during the war of 1877-78, was most satisfactory.

Pistols.—These handy little weapons were formerly made as single or double-barreled, smooth-bored, muzzle-loaders, and their system involved no departure in principle from the ordinary firearm of the day. The introduction of the revolver as a practical weapon was a great step in advance; the idea is old, and roughly constructed weapons on the same plan have long existed in museums of old arms; Colonel Colt, of the United States, revived it and is the father of the modern revolver. In his original pistol a revolving, muzzle-loading cylinder contains a number of chambers, usually five or six, bored from the front parallel to the axis; the back of the cylinder is left solid, and forms the breech; a nipple is screwed into each chamber. As the cylinder revolves, each chamber arrives at the top, and is then opposite to a barrel; the pistol is cocked by the thumb, an action which locks the chamber against the barrel, so that the two form a continuous bore; the trigger is pulled in the usual way, and the hammer brought down on the upper nipple, exploding the charge in the top chamber. The

action of recocking brings the next chamber into position. When on half-cock, the cylinder revolves freely. Since Colt's time great improvements have been made in these handy weapons; the trigger was made to cock the hammer, turn the cylinder and fire the charge by one continuous draw; this arrangement enabled the shooter to fire all the shots very rapidly without lowering his hand; the strength of mainspring required, however, rendered it very difficult to shoot with any degree of accuracy, especially as the exact moment when the hammer would fall was hard to estimate. A second improvement gave the shooter the choice of cocking the hammer and firing it in the usual way, if he preferred it. The next step was to make the chambers breech-loading, by boring them right through, and packing the powder and bullet in a strong based cartridge, carrying its own ignition. In pistols constructed on this plan the chamber arriving at the top is brought against a false breech through which the striker is driven by the hammer. In the latest pattern of this pistol, the cylinder and barrel open away from the false breech on a hinge underneath; the action of opening throws out the empty cartridge cases. If the user is on horseback, he thrusts the barrel-muzzle downward into his breast, belt or holster, the hinge remaining open; fresh cartridges are taken out of the pouch and placed in the chambers; the breech is closed sharply on the hinge and is held by a snap-catch; the pistol is then withdrawn ready for use. All this can be very quickly done with one hand while at full gallop.

Machine Guns.—This term comprehends all weapons made to fire a rapid succession of bullets from a stand or carriage, so that, while requiring but two or three men to work them, they may throw in a fire equal to that of a detachment of infantry. In the Franco-German war of 1870 a species of *mitrailleuse* was largely employed, and when used under favorable conditions attained fair success. It consisted of a number of barrels (usually twenty-five or thirty-seven) secured in a frame round an axis, and parallel to it. The barrels were open at the breech, and were loaded by a disc pierced to correspond with them containing a cartridge in each chamber. This disc was placed against the breech end of the barrels, the false breech containing the strikers was held firmly against it, and the whole of the charges were exploded at once. This arrangement had many defects. The recoil of so many charges fired simultaneously required strength and weight; at short ranges the bullets all went to the same spot; the number of rounds could not be regulated at pleasure; and only volleys could be fired. The Gatling machine gun, which first appeared in the United States, was vastly superior to the mitrailleuse, and speedily obtained entrance into the armies of most of the civilized powers.

The manufacture of ordnance is a much more scientific and complicated study than that of small arms. As the forces increase in magnitude and intensity, while the ultimate strength of material remains constant, the nicety of adaptation of means to ends grows *pari passu* with the guns. In producing a piece of ordnance, two distinct sets of conditions are involved—those belonging to its actual construction, and those by which its proportions are regulated. In constructing a gun, the material must be so selected and disposed as economically and safely to sustain the effect of the forces developed by the charge; in designing a gun, it is necessary to know the nature and direction of the forces which will combine to produce the desired ballistic results. The two sets of conditions are as distinct as those involved in the separate operations of writing and printing this article.

Nearly all the accurate knowledge as yet obtained of

the true action of gunpowder has been acquired within the last twenty years. The general idea previously held was that the explosion was instantaneous, and that the more violent the powder the greater would be the velocity of the projectile. The mode of proving the quality of the explosive was to place a small quantity in a short mortar, and to measure the distance to which it projected a light shell—a test altogether wrong in principle, as will be shown later on. No accurate idea had been formed of the true pressure of the powder gas on the bore during discharge; but it was understood that a gun was subjected to two principal strains or stresses—a circumferential tension tending to split the gun open longitudinally, and a longitudinal tension tending to pull the gun apart in the direction of its length.

When guns are made of cast metal, and are, in fact, homogeneous hollow cylinders, a limit is soon reached beyond which additional thickness is practically useless in giving strength to resist the circumferential tension. Supposing the metal employed to be incompressible, each concentric layer would take up a strain on discharge inversely proportionate to the square of its distance from the axis of the bore. Every metal, however, is compressible as well as extensible, and hence the exterior always affords more support to the interior than the foregoing rule indicates. The great aim, then, of a gunmaker is so to select and arrange his material that the exterior shall take up as much as possible of the strain thrown upon the interior.

In America, Captain Rodman introduced a method of casting guns hollow and cooling them down from the interior, so that the inner portions being first solidified were compressed and supported by the contraction of the outer parts when they subsequently cooled down. Thus, on discharge, the compressed inner portions expanded under the action of the powder gas to or beyond their natural diameter, throwing at once the strain on the outer portions which were already in a state of tension. But, however, well cast-iron may be disposed, it is naturally too weak and brittle for use with heavy guns, and those nations which employ it thus do so because it is comparatively cheap and easy to manufacture, and not because it is the best material. Austria and Russia have of late years made light guns of bronze cast in chill, and subject to the wedging action of steel mandrils driven through the bore. The several layers of the metal are thus placed in a state of tension as regards the exterior, and of compression as regards the interior. At the present day systems of building up guns have been devised so that each portion of the metal is made to bear its fair share of the strain.

The longitudinal tension is usually less important than the circumferential stress. It is considered to be provided against in homogeneous guns if the metal is as thick over the bottom of the bore as round the end. The strain is now measured by calculating the total pressure of the powder gas on the bottom of the bore, and comparing it with the area of the transverse section of the gun at the same place. This is not absolutely correct; but, practically, the chief modes of gun construction now adopted leave a considerable margin of strength in this direction.

Sir William Armstrong first successfully employed the principle of initial tensions for all parts of a gun. In his system, wrought iron coils are shrunk over one another, so that the inner tube is placed in a state of compression and the outer portions in a state of tension, an endeavor being made to so regulate the amount of tension that each coil should perform its maximum duty in resisting the pressure from within. Further, he arranged the fiber of the several portions so as to be in the best positions for withstanding the pressures. It must be

noted that wrought-iron bar is about twice as strong in the direction of the fiber as across it. He therefore constructed the exterior of the gun of coiled bars of wrought iron welded into hoops and shrunk one over the other, thus disposing the fiber to resist the circumferential strain. These outer coils were shrunk over a hollow cylinder of forged iron, having the fiber running lengthways so as to resist the longitudinal strain. Within this cylinder or forged breech-piece was placed a steel tube, gripped in a like manner by shrinkage. This grand principle of modern gun construction is carried out by turning the inner coil in a lathe to an exterior diameter slightly greater than the interior diameter to which the outer coil is bored. The outer coil is expanded by the application of heat, and slipped over the inner one. It contracts on cooling, and if the strength of the two coils is properly adjusted, the outer will remain in a state of tension, and the inner in a state of compression. On this view, the ideal gun would be constructed of a vast number of excessively thin rings so shrunk over each other that, on discharge, each should be equally strained. An attempt has been made by Mr. Longridge, M.I.C.E., to approximate to this condition by winding steel wire under tension round a steel tube. This system, though possessing much ingenuity, has never made way, and might possibly be found wanting in longitudinal strength.

Great success attended the early introduction of the coil principle. Guns of considerable size were made; the largest weighed as much as twenty-three tons, and projected a 600-pound shot with a fair velocity. It was found, however, that much difficulty attended the accurate shrinking of a number of thin rings, and that occasionally one or more of the outer ones would be strained to cracking, while the inner ones were intact.

The great German gunmaker, Krupp, employs nothing but steel in the manufacture of his ordnance. His earlier pieces were bored from solid blocks of this metal forged under heavy hammers. They were homogeneous, and therefore the exterior did not assist the interior to bear the strain of the powder gas on discharge to the extent which scientific methods of construction admit. Still the excellent quality of the material enabled the artillerist to get results from these pieces which have been surpassed only by the coil guns, and by Krupp's later productions. As, however, progress was made and the ratio of power to weight increased, it was found necessary to introduce a system of building up for steel ordnance also, and Krupp adopted the principle of shrinkage to which the English guns owed so much. The interior of the recent German gun is a steel tube as in the Armstrong construction, but it is very much thicker and forms the body of the piece, instead of being chiefly used to provide a sound surface for the bore. It is thickest over the powder and shot chambers, tapering toward the muzzle. Over the thickest part, and in some guns over a considerable portion of the chase, hoops of cast steel are shrunk on—the shrinkage being adjusted to bring the strength of the outer hoops into play to support the body of the gun on discharge. The number of hoops depends on the size of the gun and the severity of the strain it has to withstand; they are usually much more numerous than the English coils, and the section of a heavy Krupp gun presents somewhat the appearance of a stone wall. It is believed that the steel is not toughened in oil, but the details of manufacture have not as yet been made public.

Steel of the excellent quality employed by Krupp is undoubtedly a stronger material than wrought iron; its present trustworthiness is, however, of late date, and it has hardly gained the general confidence accorded to wrought iron.

In France and Italy a combination of cast iron and steel has been introduced with a view to economy. The interior of the gun is a moderately thick steel tube as in the coil guns; over this is a thick cast-iron body, corresponding to the steel body of the Krupp guns. On the exterior are shrunk steel hoops.

The comparative advantages of breech-loading and muzzle-loading for ordnance on service are fully discussed in the article GUNNERY. We have now to mention the principal modes of closing the breech, either permanently as in muzzle-loaders, or temporarily as in breech-loaders. The former is comparatively a simple matter. When the whole gun, or the interior of it, is formed of cast metal, iron, bronze, or steel, the block is merely bored to the required depth, and the end left unbored to form the breech. Should the inner part of the gun be formed of wrought material, such as coils, it becomes necessary to close the end with some device which shall render it gas-tight and strong. Several kinds of cups and plugs have been tried for this purpose, the most successful of which is the cup which is generally used in the case of the converted guns. When we come to the temporary closing of the end of the bore demanded by breech-loading, a far more difficult problem presents itself. This problem has been more or less satisfactorily solved in a great variety of ways, but it will be sufficient to examine the three principal types or systems of breech-loading employed in modern artillery. They are popularly known as the Armstrong, the Krupp, and the French systems.

The Armstrong system is the earliest of these in point of date. In it a slot is cut through the top of the breech of the gun into the tube, and a breech block, through which the vent is driven, is dropped into this slot, and is pressed firmly against the bore from behind by the breech screw, which is provided with two powerful lever handles for the purpose. Where the breech block, or vent piece, as it is usually called, presses against the lip or bore, both surfaces are of copper, and are renewed from time to time as channels are worn through between them by the rush of the escaping powder gas. There are many guns, from six-pounders to seven-inch, made on this plan in the British service, and at the time of their introduction they constituted a great advance in gun construction.

In the Krupp system a slot is cut through both sides of the breech of the gun; in this slot, in the latest patterns, runs a cylindro-prismatic wedge, or, in other words, the round side to the rear. The flat side forms the bottom of the bore. For loading, the wedge is pulled out to the left side of the piece as far as the stop will allow it to go, the shell and cartridge are thrust up the gun from behind, the wedge is pushed in, and is pressed hard home and secured by an ingeniously-conceived screw with powerful handles. The end of the bore is enlarged, and into the recess thus formed fits a Broadwell ring, against which the face of the wedge abuts when forced home. The ring is so formed that it must always fit against the wedge, and be pressed firmly to it by the action of the gas on firing. This is accomplished by making the recessed surface of the gun and the exterior surface of the ring portions of a sphere. In spite of the theoretical perfections of the system, and the excellence of manufacture attained, it has always been found that after a time — after firing a very variable number of rounds — gas would begin to escape, and then speedily cut a channel between the ring and wedge. Krupp has fully recognized this, and has been successful in minimizing and localizing the injury thus caused.

A radical difference exists between the rifling of muzzle-loaders and that usually employed for breech-loaders.

When the projectile has to be pushed down the gun from the front, it must be smaller than the bore; when it is thrust home from behind, it may be rather larger than the bore.

GUNNERY. In its early days this science might have been simply defined as the art of determining the motions of projectiles discharged from pieces of ordnance; in its present state it includes also the employment of projectiles specially adapted to the purpose in view, and the manipulation of artillery so as to enable the projectiles to produce the maximum effect.

Instruments of great precision, mechanical construction of much accuracy, and a considerable knowledge of the higher mathematics are necessary to obtain and make use of trustworthy data for the establishment of sound principles on which to base the theory of gunnery. It is therefore not surprising that, owing to the early discovery of gunpowder, the art was long practiced in a rude manner, without any attempt being made to reduce it to a science. Thus, though firearms appear to have been in use from the early part of the fourteenth century, little of value was understood of the laws regulating the flight of projectiles till the time of Nicholas Tartaglia, who published a treatise on the subject at Venice in 1537. About sixty years before that date, Leonardo da Vinci had enunciated some of the mathematical principles of trajectories in a manner which shows him to have possessed far more insight than any of his contemporaries; but he did not pursue the inquiry, and Tartaglia may be regarded as the father of ballistics. Before his time it had been generally believed that a ball on leaving the bore of a gun proceeded for some distance in a straight path,—a fallacy which lurks in the phrase “point-blank,” not yet expunged from popular speech. He saw, however, that “a piece of artillery cannot shoot one pace in a right line,” and propounded the axiom that “the more swifter a pellet doth flie, the lesse crooked is his range,”—a truth expressed at the present day by the statement that a high velocity gives a flat trajectory. This eminent philosopher claimed the invention of the gunner’s quadrant; he took into account in his calculations the resistance of the air, but placed the angle of elevation at which the maximum range would be obtained at 45° , which would only be the case *in vacuo*. Galileo was the next mathematician of note who investigated the subject. In his *Dialogues on Motion*, published in 1638, he recognized the resistance of the air, and pushed on the inquiry in the direction indicated by Tartaglia. It was not, however, till Newton’s time that a substantial basis was laid down for a true theory of gunnery. The grand discovery of the law of gravitation revealed the hitherto unguessed secret of the projectile’s fall to earth. Toward the end of the seventeenth century he investigated the trajectory of a projectile on the supposition that the resistance of the air varied as the first power of the velocity. Bernoulli in 1718 gave a solution of the problem, on the supposition that the resistance varied as any given power of the velocity. No further progress was made till Benjamin Robins in 1742 published his *New Principles of Gunnery*, in which he furnishes a notable example of the manner in which theory should be wedded to practice, and hypothesis to experiment. He invented the ballistic pendulum, and was the first to ascertain experimentally with any degree of correctness the velocities of projectiles on leaving a gun. The weight of Robins’ first pendulum was fifty-six pounds, and it was therefore only suited for small arms. It could measure the velocity at only one point each round, and therefore, to ascertain the velocity lost by a ball in passing through the air, it was necessary to fire a series of rounds at one distance, and afterward a

similar series of rounds at another distance. Velocities of 1,700 feet per second were measured, and the loss of velocity due to the resistance of the air, up to a distance of 250 feet from the muzzle, was approximately ascertained. Robins discovered that the resistance of the air was greatly increased as soon as the ball traveled faster than sound, and attributed it to the creation of a vacuum behind the shot, into which the air could not rush with speed greater than that of sound. Count Rumford in 1751 made use of the recoil to measure the velocities of bullets, on the principle that the momentum of the bullet forward was equal to the momentum of the gun backward. To carry this out the gun was suspended as a pendulum, and the length of the arc it described on firing measured. By firing a bullet from a gun thus suspended into the ballistic pendulum, two independent records were obtained, and it would have been easy to calculate the loss of velocity, from the muzzle to any range at which the pendulum could be hit, by the combination. Doctor Hutton next took up the inquiry, and increased the weight of the pendulum and the bullets. No very great advance, however, seems to have been made till 1840, when experiments on the resistance of the air to the motion of spherical shot were carried on at Metz by the French Government. MM. Piobert, Morin, and Didion were the chief experimenters. They raised the weight of the receiving pendulum to nearly six tons, and fired into it fifty-pound balls at a range of 330 feet. The information now obtained spread over a much wider field than that traversed by Robins. It was even found possible to construct the trajectories of projectiles with some approach to truth, and empirical formulæ were laid down by which ranges and times of flight could be approximately calculated. It was not, however, till the introduction of electricity as a means of determining the velocities of projectiles that accurate knowledge of the resistance of the air was obtained. In 1840 Professor Wheatstone invented an instrument for this purpose, called the electro-magnetic chronoscope. He has had many successors, whose productions exhibit a great amount of ingenuity; those from which the most valuable results have been obtained, and which are in use at the present moment, are the Bashforth chronograph, the Noble chronoscope, the Le Boulengè chronograph, and the Watkin chronograph.

Projectiles.—The requirements of modern artillery have necessitated many complications in the preparation and use of projectiles, which now vary greatly in their nature and in the purposes for which they are employed. A general description of the several kinds supplied to European armies will be found under ammunition, and but few remarks will be required to connect them with the guns for which they are intended. Smooth-bored ordnance use solid round shot and case, common shell, and diaphragm shrapnel shell. Solid shot are used against masonry, wooden shipping and masses of men. They were at one time fired red-hot at shipping. Roughly, the cube of the diameter in inches multiplied by 0.133 gives the weight of the shot in pounds. Case shot consist of iron balls packed in iron or tin cylindrical cases. They are effective up to about 350 yards against troops, boats and rigging, and are especially suitable for flanking ditches. Common shell are completely filled with powder, and are burst in flight by time fuses, or, on striking, by percussion fuses. They are used against men in masses, buildings, works and material generally. Diaphragm shrapnel shell contain a small bursting charge and a number of balls. They are fitted with a time fuse which explodes the charge when they near the object, so that the released bullets fly forward.

The great advantage of rifling was long recognized in small arms and sporting pieces before it was extended to ordnance. The first rifled arms threw bullets which, except for certain projections designed to fit the grooves of the barrel, were spherical. These guns surpassed smooth-bores in accuracy, but it was not until the introduction of elongated projectiles that a distinct gain in power was recognized. The gain in accuracy is due in great measure to the superior correctness with which the ball is centered in the bore by the action of grooves, while the rotation imparted to it annuls or greatly lessens the disturbing effect of the pressure of the air on surface inequalities, or of variations in the position of the center of gravity. Thus, in addition to greater accuracy, rifling confers a flatter trajectory and greater penetration. The elongated form permits a head of the best shape, an increase in the contents of the shell, and the use of fuses which explode when the point strikes an object. The projectiles used with rifled guns are case shot, common shell, Shrapnel shell, and Palliser shell. The case shot differ little from those made for smooth-bore ordnance. Common shell are generally from two and a half to three calibers in length. They are designed to contain as much powder as possible, consistently with strength of wall to resist the shock of firing. Their effect is almost entirely due to explosion; velocity has little to do with it beyond conferring range and penetration. Common shells are generally fused with percussion fuses. The introduction of iron-clad ships is almost entirely due to the terribly destructive fire of shells. Shrapnel shell are filled with bullets, and have a bursting charge only sufficient to open the case and release the contents, which then fly forward with the velocity possessed by the projectile before breaking up. To get satisfactory results from time fuses it is necessary to have a gun which shoots with great regularity, a fuse composition which burns evenly, and an accurate mode of setting the fuse. Of late years improvements in powder and design of ordnance have rendered the velocities practically uniform. The fuse composition is somewhat liable to deterioration, but is tolerably satisfactory; and a new fuse auger has just been introduced which can be set to any desired degree of accuracy. As the power of Shrapnell shell is entirely due to the velocity possessed by the bullets when freed from the envelope, it is of paramount importance in long-range firing that the shell should start with a high velocity and retain as much of it as possible. With the more modern field guns the effective range of Shrapnel extends up to about 3,000 yards; with heavy guns, to 4,000 or even 5,000 yards.

Palliser shells are made of a mixture of selected brands of iron, and are cast in molds so constructed that the metal of the head is in contact with iron and that of the body with sand. The head is thus "chilled," as the rapid carrying off of the heat by the iron mold causes the particles of the metal to dispose themselves rigidly, and confers intense hardness, which property is essential for the penetration of iron plates. The greatest penetration of armor yet known was obtained by the eighty-ton gun at Shoeburyness in 1877. The target consisted of four eight-inch wrought-iron plates, sandwiched with three five-inch layers of teak, the whole put together with immense strength. The projectile perforated three plates and the teak, digging its nose about half way into the last plate, which was much cracked and bulged. The 100-ton gun has perforated with ease twenty-two inches of solid wrought iron plate, strongly backed, but failed to drive a hole through a similar target when the plate was of steel. Very recently extraordinary penetration has been obtained by a six-inch seventy-pounder made by

Sir W. G. Armstrong & Co. Fired with a velocity of nearly 2,000 f. s., this small projectile pierced about eleven inches of wrought iron. The subject of penetration is treated under GUNMAKING.

Guns were formerly primed with loose powder and fired by a match, next by common quill tubes filled with composition and ignited by a portfire, then by detonating tubes exploded by a hammer. Now friction tubes have superseded these methods for ordinary service. When it is desired to fire a gun from a distance, or to fire a number of guns absolutely at the same moment, Abel's electric tubes are employed.

The general principles guiding the employment and manipulation of artillery are applicable to the schemes of warfare of all civilized nations. The details of manufacture, the systems of loading and the methods of rifling, are the chief points regarding which artillerymen differ; these matters are treated under GUNMAKING. Of two pieces constructed with equal skill to perform the same kind of work, the heavier will always be the more powerful. Thus weight is the chief controlling element in the employment of guns, though cost and convenience of manipulation have often to be taken into account. The artillery of the present day is the outcome of a long series of improvements, and the whole system of this important arm bears traces of frequent modification and continual compromise. The first introduction of firearms appears to have taken place in England in the reign of Edward III. On the Continent it was probably somewhat earlier, but the actual date and the circumstances attending their introduction are involved in obscurity. It is said that cannon were used in the English expedition against Scotland in 1327, and at the battle of Crécy in 1346. In 1360 there were four copper guns in the Tower. For about two centuries cannon continued to be manufactured of copper, brass, or bronze, good castings of which were made long before the art of smelting iron ores was perfected. In the early part of the sixteenth century guns were sometimes made of wrought iron plates put together longitudinally and hooped with wrought iron. In 1545 cast-iron ordnance was manufactured in England, and supplanted pieces of all other materials for a time. The growing needs of warfare, however, soon demanded guns possessed of fair mobility to accompany armies in the field, and the cast iron pieces used being found excessively cumbrous, bronze was once again resorted to for field artillery. From about the middle of the seventeenth century till the introduction of rifled cannon, all the heavier species of ordnance—fortress, siege and ship guns—were made of cast iron; and all the lighter—field and boat guns—of bronze. In 1717 the bronze foundry was established at Woolwich, and most of the smooth-bored field pieces, howitzers and mortars used in the service were made there. The heavy cast iron guns were supplied by contractors, and proved by government officials. The long peace which succeeded the Napoleonic wars was highly unfavorable to the progress of gunnery, but a great development took place in the arts and sciences, so that, on the breaking out of the Crimean War, the latest discoveries in metallurgy and the excellence attained in machinery at once enabled inventors to make a great advance in artillery. At the transition period, a few wrought iron smooth-bores, throwing spherical shot of 150 and 100 pounds, were manufactured to overcome the resistance of iron plates then recently introduced for armoring ships. These pieces were speedily discarded for rifled guns; and practically it may be said that the adoption of steel and wrought iron for guns coincided with the change from smooth-bores to rifles, both steps of progress being thoroughly established about 1860. In

spite of the great superiority of the new ordnance, it cannot be said that the old pieces are yet superseded; vast numbers of them exist over all parts of the world, and often form the only defense. Even the fortifications in England are still largely armed with them on land fronts; and though they are gradually disappearing, they yet claim notice. Bronze guns are now obsolete in the British service. Those denominated according to the weight of their projectile are made strong enough to fire solid shot or shell; those called by the diameter of the bore fire shell only. It must be remembered that, with spherical projectiles, the solid must be heavier than the hollow kinds, which need not be the case with rifled ordnance, as the projectile may be of any length. The guns are used for direct fire, the howitzers for curved fire, the mortars for vertical fire *i.e.*, they are set at 45° elevation, and the requisite range attained by varying the charge of powder, instead of firing at various degrees of elevation, as with guns and howitzers.

The old field smooth-bores were fairly effective up to 1,000 or 1,200 yards, and so established a great superiority over the smooth-bored musket; but as soon as the rifled musket was generally adopted, an advance in artillery power became necessary if the arm was to retain its position in the scale of efficiency. After the Crimean war, Napoleon III. rifled his bronze field guns on Treuille de Beaulieu's system, and the new pieces exhibited great merit at Magenta and Solferino in 1859. England, and indeed every European power, was busily engaged in experimenting during this period. The early Armstrong guns in England, Broadwell's and Krupp's in Prussia, and imitations of the French plan in other countries, speedily caused field artillery to regain its place in war. The northern kingdoms of Denmark and Norway and Sweden, favored by specially good iron ores, and free from the immediate alarm of war, retained cast iron as the material for light ordnance. Prussia had already begun to use steel for smooth-bores, and naturally adhered to it for rifled guns, while the coil system brought forward by Armstrong was found cheap and enduring in England. The new Prussian guns were breech-loaders, constructed on the double-wedge system; they proved unsatisfactory, and since the Franco-Prussian war of 1870-71 have been abandoned in favor of a single-wedge system of great neatness and efficiency. The Armstrong guns were also breech-loaders, and when tested by land and sea, on actual service in China, New Zealand, and Japan, proved to be very powerful when compared with the old smooth-bores, but also exhibited many defects of construction. At this time no thoroughly successful breech-loader had been invented, and England reverted to muzzle-loading, while the Continental powers for the most part endeavored to improve their methods of breech-loading. England's field artillery was undoubtedly the most powerful known at that period. No one was more alive to this fact, or more dissatisfied with it, than the Germans. Their great gunmaker, Krupp, forthwith improved his breech-closing fittings, and instituted series upon series of experiments till he produced two guns—one for horse artillery, and one for field batteries, also horsed—which were an enormous advance on the weapons previously employed against the French. The lighter gun weighs seven hundred weight, and throws a shell of eleven pound weight, with a muzzle velocity of 1,525 feet per second; the heavier weighs nine hundred weight, and throws a shell of seventeen-pound weight, with a muzzle velocity of 1,460 feet per second. These are figures indicating power not to be attained by the English eight hundred weight gun, or even the newer pattern of six hundred

weight, throwing a nine-pound shell with a muzzle velocity of 1,380 feet per second, and the twelve-hundred weight gun, throwing a sixteen-pound shell with a muzzle velocity of 1,360 feet per second. The immediate consequence of the introduction of these improved German pieces was the instituting of a series of experiments in England which resulted in the production of a muzzle-loading field gun, weighing eight hundred weight, throwing a thirteen-pound projectile with a muzzle velocity of 1,560 feet.

Important as are the land-service pieces of the army to England, yet, viewing her naval supremacy as one of the chief sources of her greatness, we must consider heavy ship and coast-defense ordnance to take the first place in modern gunnery. The contest between guns and armor has now continued with scarcely any intermission for upward of thirty years, during which time the armor was increased in thickness from four to twenty-four inches, and the guns from 68-pounders to 2,500-pounders; that is, from the most powerful of the old cast-iron smooth-bores to the one-hundred-and-ten-ton gun. The first armor-piercing rifled guns were the seven-inch Armstrong breech-loaders, but their supremacy was of short duration. They were the heaviest made on that system, and were speedily succeeded by far more powerful muzzle-loaders. In 1867 eight-inch and nine-inch guns had already been introduced. The nine-inch Woolwich rifled gun of twelve tons was tried in competition with the fifteen-inch American smooth-bore, which weighed nearly half as much again, against armor. The British piece gained a decisive victory. In 1868 it was decided to introduce a ten-inch gun of the same character. Since that time progress has been continual. For a full account of modern productions in the line of heavy ordnance, see article on ORDNANCE.

The development which has taken place of late years in the power of artillery has necessitated corresponding changes in gun carriages. Formerly, every carriage was capable of traveling to some extent; even the heaviest guns were mounted on carriages fitted with trucks, which permitted motion on the ramparts or about a deck. Later on, sloping traversing platforms were introduced, up which the gun carriage recoiled on firing. Extra means of checking recoil became necessary as the power of the guns grew; compressors, or friction plates were introduced, and are now only partially superseded by the hydraulic buffer. Mobility of carriage has almost entirely been given up, except for field and mountain artillery. The heavier siege guns travel on platform wagons, not on their firing carriages; and it is possible that the traversing platform and slide principle will extend yet further.

Several kinds of carriages on the "disappearing" principle have from time to time been put forward. In these the gun is exposed to the fire of the enemy only while being aimed and discharged; loading is performed under cover. The Moncrieff carriages are the most successful of this class. In them the force of recoil is stored up, and employed to raise the gun from the loading to the firing position. The counter-weight carriages are used to some extent in coast defense, and the hydro-pneumatic carriages are under trial for siege-train guns. As soon as the weights of ordnance increased so greatly that their service exceeded the power of manual labor, it became necessary to find some substitute. Steam power is always at hand in steam vessels, and it was quickly seen that it was best applied through the medium of water pressure. The simplicity and compactness of hydraulic machinery, the circumstance of its direct action rendering toothed gear unnecessary, and the perfect control it gives over the motion of heavy weights, especially adapt it for the purpose.

Many other applications of hydraulic power to gunnery besides those just described are due to Mr. G. Rendel of the great Elswick firm. One of the most novel is that adopted in H. M. S. *Téméraire*, in which twenty-five-ton guns are mounted on the disappearing principle in a turret having no roof and no ports; inside the turret is a turn-table carrying the gun by the trunnions on two arms, which are raised by hydraulic power, enabling the gun to fire *en barbette* over the wall of the turret. The recoil brings it down again, and it is placed opposite the loading gear by revolving the turn-table. The general principles are the same as those on which the previously described systems are constructed.

This article would be scarcely complete without a reference to the comparative advantages of the muzzle and breech-loading systems. Many have been much impressed with the great superiority of breech-loaders as small arms, whether for sporting or military purposes, and have concluded that the same superiority must extend to ordnance constructed on this plan. Others, having seen the difficulty of avoiding complication and accident to the parts in the early breech-loaders, have hastily condemned the whole system. The truth as is often the case, lies between the two views, as will be seen from the following considerations. The chief points of excellence to be attained by a field gun are—(a) high ratio of power to weight; (b) immunity from injury by its own fire; (c) immunity from injury by the enemy's fire; (d) capability of supporting the accidents of service; (e) rapidity and facility of manipulation; (f) efficiency of projectile. (a) The power of a gun is most conveniently measured by the energy (in foot tons) communicated to the projectile on leaving the muzzle.

GUNNY. This name is applied to cloth or bags made of jute, and is supposed to be derived from *gang*, or *gania* of Rumphius, or from *gonia*, a vernacular name of a plant common in Madras.

The seeds of the jute plant are sown in April or May, and the plant is cut down close to the roots just before flowering. The tops are then clipped off and the stems made into bundles, which are placed in tanks or ditches and covered with turf or other heavy substances to keep the bundles under water. Here they are watched anxiously day by day till the fiber separates easily from the central woody portion. The period of retching or soaking takes from eight to ten days; if allowed to remain too long, the fiber rapidly decays. In drying also the fiber generally becomes of a deeper color. When the fiber is ready for manipulation, the operator descends into the tank or ditch, and taking ten to fifteen bundles, strips off the baky fiber and washes thoroughly, and by a dexterous movement of the wrist spreads and separates the fibers over the surface of the water. The fiber soon becomes clean, and is hung over bamboo framework to dry. The fiber thus obtained is fine, long and silky, but the short staple and the portion near the root held in the hand of the operator during washing, which frequently has bark attached, are the portions generally selected to make gunny bags or cloth of.

The kind of cloth known as gunny, tat, choti, etc., is woven in various length and widths for use as bedding, bags, etc., and formerly, more than at present, every man, woman, and child, boatmen, husbandmen, and others, in their spare moments, distaff in hand, wove gunny cloth. On the eastern frontier women are clothed in it, and the poor cover themselves with it at night. In the Malayan Archipelago it is no unusual sight to see a poor Chinese coolie with a dress made of gunny cloth. The great and most important use, however, to which gunny cloth is applied is in making bags wherein to pack rice, linseed, sugar, cotton and other products for shipment.

As soon as this cheap, strong, and serviceable material became known, the manufacture speedily assumed enormous proportions, and vast quantities of jute were imported into Dundee for the manufacture of gunny bags and cloth alone. The Dundee mills, in the early period of this trade, had only Indian hand-woven gunnies to compete with. The introduction of the latest machinery of the most approved patterns into Bengal, the chief seat of this industry in India, has, however, had the effect of giving India the opportunity of competing with the Dundee mills on advantageous terms, and now India supplies vast quantities of gunnies to Europe, Egypt, Ceylon, the Malayan Archipelago, China, and the United States. In America alone it is computed that the annual average outturn of cotton is 3,500,000 bales, each bale requiring six yards of wrapping material and of this one-third at least is supplied in gunny cloth.

GUNPOWDER. Upon the great importance of the invention of gunpowder it is needless to dwell. Not only has it revolutionized the art of war, and given the forces of civilization a vast advantage over mere numbers and savage valor, but we may even urge, paradoxical though it appears, that the very improvements by which modern science has rendered military machines more deadly tend to make war far more expensive, and therefore to prevent its being so frequently or so rashly undertaken as of old. Besides such indirect services to civilization, gunpowder has been and is of great use in the arts of peace, although of late years to a certain extent superseded by more potent explosive agents.

Such being the case, it is not a little remarkable that the discovery of gunpowder should be veiled in uncertainty, although this very obscurity seems proof of its great antiquity. It is, however, certain that it was *not* invented, as has been often stated, by the German monk Bertholdus Schwartz, about 1320, although Wilkinson, in his *Engines of War*, considers Schwartz may have suggested the use of a mortar, since the form as also the name of this piece of ordnance may well have been due to some accident in the laboratory. Roger Bacon, who was born in 1214, refers, *circa* 1267, to an explosive mixture of the nature of gunpowder as known before his time, as being employed for purposes of diversion, and as producing a noise like thunder, and flashes like lightning; he even suggests its application to military purposes, and indulges in the supposition that some such composition might have been employed by Gideon to destroy the Midianites. Marcus Græcus, who lived about the end of the eighth century, was not ignorant of the military uses to which the composition might be put; among other modes of launching fire upon an enemy he gives one to the following effect:—one pound of live sulphur, two of charcoal of willow, and six of saltpeter, reduced to a fine powder in a marble mortar and mixed together; a certain quantity is to be put into a long, narrow and well compacted cover, and then discharged into the air. This is evidently the description of a rocket. It has also been suggested that Bacon may have learnt the secret in Spain, in which country he is known to have traveled, and whose Moorish masters were then far in advance of the rest of Europe in science and literature. There is a treatise on gunpowder in the library of the Escorial, written about 1250, which appears to describe both rockets and shells; the Arabians are, from this and other authorities, supposed to have enclosed combustible or explosive compositions in hollow globes of iron, which were discharged upon the foe either by hand, like the modern grenade, or from the warlike machines then in use; it has also been stated that toward the close of the thirteenth century they projected small balls from tubes carried in the hand, or attached to the end of a lance, and only used at close

quarters, being in fact hand-guns. Rockets were employed during the reign of the Greek Emperor Leo, about 880, and indeed seem to have been known in India from time immemorial, some of them having been made of great size.

The gloom of the dark ages precludes further attempt to trace back the history of gunpowder with any certainty.

It is almost certain that those authors who assert that the Arabians used gunpowder at the siege of Mecca, 690 A.D., having derived their knowledge of it from India or China, confound gunpowder with Greek fire, which seems to have been the generic name given to several different combustible mixtures, although Arabian writers speak of them as Chinese fires. Greek fire was introduced into Constantinople from the East about the year 673; it was discharged upon the enemy by means of various engines of war, or in smaller quantities attached to arrows or darts. The Saracens used it against the Crusaders.

However, its actual destructive effect seems to have been very inadequate to the terror it occasioned. From the account of Geoffrey de Vinesauf, sand and earth, but especially vinegar, appear to have been considered the best extinguishers; water would not put it out. One description of this wildfire was composed of resin, sulphur, naphtha, and probably saltpeter. Bacon states that religious scruples hindered European nations from adopting Greek fire; but if so, they seem to have been gradually overcome, for its use is mentioned by various writers, Anna Comnena, Père Daniel, and Froissart among them.

The researches of all authorities seem to point to the far East as the birthplace of an explosive mixture of the nature of gunpowder; it was used there from time immemorial, although doubtless its application as a propelling agent is of far later date. In all probability, the germ of the science of explosives lay in the accidental discovery of the peculiar properties of the niter so plentifully found mixed with the soil upon the vast plains of India and China. By means of the charred embers of wood-fires, used for cooking, the two most active ingredients of gunpowder might easily be brought into contact, and, under the action of heat, more or less deflagration would ensue; in fact, the accidental dropping of some of the crude saltpeter into the coals would show its remarkable power of supporting and accelerating combustion. The combination of saltpeter and charcoal in a more or less powerful mixture can therefore be easily conceived, the sulphur being an after addition, and not necessary to cause explosion. Our present gunpowder is only the improvement and perfection of such a mixture. Saltpeter was early known as "Chinese snow," and some have supposed the use of gunpowder in cannon to have been known in China very soon after, if not before, the Christian era. But this seems to be an error, for Colonel Anderson, C. B., in his book on gunpowder (London, 1862), quotes a conversation held by John Bell of Antermony, who visited Pekin in 1721, with the emperor's general of artillery, to the effect that from their records it had been used in fireworks, etc., for about 2,000 years, but that its application to the propulsion of shot was a late introduction. Some of their compositions had such names as "devouring fire," "earth thunder," etc. The *Institutes of Timur*, written about the middle of the fourteenth century, contain no mention of cannon or gunpowder, although full particulars are given of the equipment of his troops; it is, however, related that when Timur engaged the army of Mahmud under the walls of Delhi, men scattered wildfire and flung rockets in every direction.

Whatever obscurity may hang over the early history of gunpowder, it seems most probable that its employment as a propelling agent originated among the Moors or Saracens — whose civilization for several centuries contrasted forcibly with the intellectual darkness of Christendom — and from them spread eastward, as well as northward into Europe. The first reliable contemporary document relative to the use of gunpowder in Europe, a document still in existence, bears date February 11, 1326; it gives authority to the priors, the gonfalonier, and council of twelve of Florence to appoint persons to superintend the manufacture of cannon of brass, and iron balls, for the defense of the commune, camps, and territory of the republic.

If the testimony of John Barbour, archdeacon of Aberdeen, who wrote in 1375, is to be believed, cannon, which he calls “crakys of war,” were employed during the invasion of Scotland by Edward III. in 1327; but they are not mentioned in the accounts of the expenses of this war preserved in the record office. From the year 1345, 19 Edward III., we have, preserved in the record office, reliable accounts of the purchase of ingredients needed for the fabrication of gunpowder, and of the shipping of cannon for France. In 1346 Edward III. ordered all the saltpeter and sulphur that could be found to be bought up for him, but the quantities obtained were very small. Whether it be true or not that cannon were used by the English at Crécy in that year belongs rather to the question of the employment of artillery in the field; it has been maintained that such was the case by Napoleon III.

In the year 1377, being the first of Richard II., Thomas Norbury was ordered to buy, among other munitions, sulphur, saltpeter, and charcoal to be sent to the castle of Brest. In 1414 Henry V. ordered that no gunpowder should be taken out of the kingdom without special license; in the same year this monarch also ordered twenty pipes of powder made of willow charcoal, and various other articles for the use of the guns.

It was not, however, until the reign of Elizabeth that the manufacture of gunpowder can be said to have been established in England. The greater portion required had been previously imported from abroad, and the trade had been an open one; but the threatening attitude of Spain compelled the government to provide more efficient means of defense, and patents were issued by the crown for the manufacture of gunpowder, constituting it a monopoly. Early in this reign also, saltpeter began to be artificially produced in England, but the quantity so obtained formed a very small proportion of the supply needed, the remainder being brought from various parts of the Continent, and from Barbary. Again, in 1623, nominally in order to prevent the sale of weak or defective powder, a proclamation was issued by James I., prohibiting its manufacture, as well as that of saltpeter, except under the king’s commission, and directing that all gunpowder should be proved and marked by the sworn proof-master. A little later, in 1626, the East India Company had commenced the importation of saltpeter, and had also erected powder works in Surrey. Their renewed charter in 1693 contained a clause providing that 500 tons of saltpeter were to be furnished to the ordnance annually, and from this time forward we hear of no difficulty, at least in England, of obtaining the chief ingredient of gunpowder, although on the Continent great attention has been paid to its artificial production; this was especially the case in France during the reign of Napoleon I., when the supremacy of Great Britain at sea for many years prevented the importation of saltpeter by her enemies.

At the year 1590, George Evelyn, grandfather of

the celebrated John Evelyn of Wooton, received the royal license to set up powder mills at Long Ditton and Godstone; the Evelyns are said to have brought the art from Holland. The works at Faversham, afterward for so many years the government gunpowder factory, date from Elizabeth’s reign, but were then of secondary importance to those at Godstone. There seems reason, however, to suppose that powder mills existed at Waltham Abbey so far back as 1561. The Waltham Abbey works have been greatly enlarged of recent years, and no expense has been spared to render them, by the introduction of new and improved machinery, the most complete as well as the safest in the world.

The earliest gunpowder used in cannon in Europe consisted of equal parts of saltpeter, charcoal and sulphur, ground up and mixed together as required. To account for the use of such a very weak composition long after better proportions had been ascertained, it must be remembered that the earliest cannon were composed of iron staves roughly hooped together; and tubes of thin iron, or even of wood or leather, with rope coiled round them, were sometimes used. Indeed, the effective application of gunpowder as a propelling agent involves a whole series of inventions, and it was doubtless chiefly owing to the backward state of mechanical science during the Middle Ages that such weak powders were employed. The slow growth of artillery science in Europe for five centuries, and its rapid development in very recent years, are facts which support this presumption. Even about 1410 the proportions were still but three saltpeter, two sulphur and two charcoal. The relative amount of saltpeter was gradually increased, and Tartaglia (*Quesiti e Inventioni diversi*, Venice, 1546) mentions twenty-three various compositions as having been used at different times.

It is remarkable that Robins states the above proportions to have been very nearly those of his own day (1742), for there is a great deficiency of saltpeter in the cannon powder, and a considerable excess in that for muskets, compared with the relative qualities now employed in England. For a long period of time it was the custom for the fine grain or musket powder to contain a larger proportion of saltpeter than that for cannon; and, again, the amount of the niter was relatively reduced as the piece of ordnance became heavier, doubtless with the view of obtaining a slower burning powder for large charges. However, we find that by the latter part of the last century, what was called “common war powder” was almost universally composed of six saltpeter one charcoal and one sulphur, and these are the proportions still in use by many Continental nations.

The following table gives the percentage composition of gunpowder as now made in different countries for military purposes:

	Saltpeter.	Charcoal.	Sulphur.
England, Royal Gunpowder factory.....	75	15	10
France	75	12.5	12.5
Germany.....	76	14	10
Austria.....	76	14	10
Russia.....	75	15	10
Belgium.....	75	12.5	12.5
Spain { Cannon powder.....	75	15	10
{ Rifle “	75	12.5	12.5
United States.....	75	12.5	12.5

The best sporting powders have about the same composition as those made by Government. Wherever cheapness is the chief object in view, the quantity of

niter is diminished, and the other two components relatively increased. Some of the powder for the African trade, commonly called "nigger powder," does not contain much more than 50 per cent. of saltpeter, while other kinds are nearly as bad. Blasting powder contains a low proportion of saltpeter, from 60 to 62 per cent., but, although this reduction may originally have been made in order to manufacture a cheaper article, yet it is also the most effective for the object desired in many cases, which is to remove large masses of earth or soft rock, and this can best be done by using a comparatively weak or slow-burning powder. The element of time is here of great importance; a very quick-burning or violent explosive would not displace such large masses of a soft material, although the local effect would be more destructive.

GUNPOWDER PLOT. See **FAWKES**.

GÜNS (Hungarian, *Kőszeg*), the second town in importance of the Hungarian megye or county of Vas (Eisenburg), near the Styrian frontier, is situated on the Gyöngyös. It is the see of a bishop, and from 1648 until the recent administrative changes of 1876 was a royal free town. Population (1890), 7,500.

GUNSHOT WOUNDS. Although excessive bleeding is not so common after gunshot as other kinds of wounds, it may occur immediately to a fatal extent, if assistance be not afforded. This assistance any one can give. It consists simply in placing the fingers in the wound, and if the vessel can be reached, pressing them upon it, directed to the proper point by the warm gush of blood. Should the wound be too small to admit the finger, a handkerchief may be tied around the limb above the wound, and twisted tightly with a stick. It is well to examine the wound, to ascertain the extent of the injury done, and whether there are splinters of bone or portions of dress lying in it. If so, they should be removed. But neither the examination nor the removal should be attempted if they seem likely to aggravate the injury. The treatment is similar to that of other wounds, and consists in protecting the part during the healing stages, moderating inflammation by cold-water dressings or soothing poultices, and hastening the last stages of cure by stimulating lotions.

GUNTER, EDMUND, was born in Hertfordshire in 1581. He was educated on the royal foundation at Westminster school, and in 1599 was elected a student of Christ Church, Oxford. After graduating bachelor and master of arts at the regular times, he took orders, became a preacher in 1614, and in November, 1615, proceeded to the degree of bachelor in divinity. Mathematics, however, which had been his favorite study in youth, continued to engross his attention, and on March 6, 1619, he was appointed to the professorship of astronomy in Gresham College, London. This post he held till his death, which took place on December 10, 1626. With Gunter's name are associated several useful inventions, descriptions of which are given in his treatises on the *sector, cross-staff, bow, quadrant, and other instruments*.

Gunter's Chain, the chain in common use for measuring land, is twenty-two yards long and is divided into 100 links. Its usefulness arises from its decimal or centesimal division, and the fact that ten square chains make an acre.

Gunter's Line, a logarithmic line, usually laid down upon scales, sectors, etc. It is also called *the line of lines* and *the line of numbers*, being only the logarithms graduated upon a ruler, which therefore serves to solve problems instrumentally in the same manner as logarithms graduated upon a ruler, which therefore serves to solve problems instrumentally in the same manner as logarithms do arithmetically.

GÜNTHER, JOHANN CHRISTIAN, German poet, was born at Striegau in Lower Silesia, on April 8, 1695. He entered in 1715 the university of Wittenberg with the view of studying medicine; but he became idle and dissipated, contracted heavy debts, and came to a complete rupture with his father. In 1717 he went to Leipsic, where he obtained the friendship of Menck, and published a poem on the peace of Passarowitz, which acquired him an immediate reputation. Merck recommended him to the king of Poland, but unhappily the first time he appeared at court he was in a state of intoxication. From that time he led an unsettled and dissipated life, depending for an uncertain subsistence partly on money obtained for occasional poems and partly on the charity of his friends. He died at Jena, March 15, 1723, when only in his twenty-eighth year. Goethe pronounces Günther to have been a poet in the fullest sense of the term.

GUNTOOR, a town in Kistna district, Madras, situated on the Grand Trunk road, about forty-six miles from Masulipatam. Population, 18,033.

GURDÁSPUR, a British district in the lieutenant-governorship of the Punjab. Few facts can now be recovered with regard to the early annals of Gurdáspur. Our first distinct historical knowledge begins with the rise of the Sikh confederacy. The whole of the Punjab then was distributed to the chiefs who triumphed over the imperial governors. In the course of a few years, however, the famous Ranjit Singh acquired all the territory which those chiefs had held. Pathámkot and the neighboring villages in the plain, together with the whole hill portion of the district, formed part of the area ceded by the Sikhs to the East India Company after the first Sikh war in 1846. In 1861-62, after receiving one or two additions, the district was brought into its present shape, having its headquarters at Gurdáspur. Area 1,822 square miles; population about 1,000,000.

GURGÁON, or GOORGAON, a British district in the lieutenant-governorship of the Punjab. In 1803 Gurgáon district passed into the hands of the British after Lord Lake's conquests, and under their influence improvements made steady and rapid progress. On the outbreak of the mutiny of Delhi, in May, 1857, the nawáb of Farrukhnagar, the principal feudatory of the district, rose in rebellion. The Meos and many Rájput families followed his example. A faithful native officer preserved the public buildings and records at Rewári from destruction; but with this exception, British authority became extinguished for a time throughout all Gurgáon. After the fall of the rebel capital, a force marched into the district and either captured or dispersed the leaders of the rebellion. The territory of the nawáb was confiscated on account of his participation in the mutiny. Civil administration was resumed under orders from the Punjab Government, to which province the district was formally annexed on the final pacification of the country. Area, 2,500 square miles. Population over 700,000.

GURNALL, WILLIAM, author of the *Christian in Complete Armour*, was born in 1616 at Lynn, Norfolk-shire. He was educated at the free grammar school of his native town, and in 1631 was nominated to the Lynn scholarship in Emmanuel College, Cambridge, where he graduated B.A. in 1635, and M.A. in 1639. Nothing is known of his history from the time that he left the university till 1644, when he was made rector of Lavenham in Suffolk; but it would appear from one of his letters, that when he received that appointment he was officiating as minister of Sudbury. At the Restoration he signed the declaration required by the Act of Uniformity, and on this account he was the subject of a libelous attack, published in 1665, entitled

Covenant-Renouncers Desperate Apostates. He died October 12, 1679, and was buried at Lavenham.

GURNARD (*Trigla*). The gurnards form a group of the family of "mailed cheeks," and are easily recognized by three detached finger-like appendages in front of the pectoral fins, and by their large, angular, bony head, the sides of which are protected by strong, hard, and rough bones. The pectoral appendages are provided with strong nerves, and serve not only as organs of locomotion when the fish moves on the bottom, but also as organs of touch, by which it detects small animals on which it feeds. Gurnards are coast-fishes, generally distributed over the tropical and temperate area.

GURWAL. See **GARHWÁL**.

GUSTAVUS I., king of Sweden, commonly known as **GUSTAVUS VASA**, the surname being derived from the family arms, which were a bundle or sheaf, is justly celebrated as the founder of modern Sweden; he delivered it from the yoke of Denmark, introduced the Reformation, established law and order, and laid the foundation of its industrial prosperity. His family name was Ericson; he was born about 1496 of a noble house; and he was related to the powerful family of Sture. Gustavus was at a very early age called upon to suffer for his country. Sweden was still joined to the other Scandinavian kingdoms under the union of Calmar, Denmark being the leading state. Sweden was a reluctant member of this union, and King Christian of Denmark was obliged to maintain his supremacy with a high hand. In an expedition to Stockholm this king treacherously carried off the young Gustavus and other nobles as hostages to Denmark. After being detained in Jutland for above a year, Gustavus managed to escape in disguise to Lübeck, and the great Hanse town, ever jealous of the power of Denmark, furnished him with the means of returning to Sweden, where he landed in 1520. He had now formed the resolution to deliver his country from the oppression of the Danes. He went about from place to place trying to incite the people to revolt, but on all hands he met with apathy and even resistance. For some time his life was in extreme danger; he was hunted by the Danish authorities, and worked in disguise on the farms and in the mines of Dalecarlia. The barn in which he threshed corn is preserved as a state monument. He was on the point of fleeing over the hills into Norway, when tidings came of the Blood-bath of Stockholm, in which ninety of the nobles and leading men of Sweden, including the father of Gustavus himself, were executed by the Danish king. This deed roused the slumbering patriotism of the Swedes, especially of the hardy people of Dalecarlia, who now chose Gustavus as their leader (1520). They repeatedly defeated the Danish forces, and took the principal towns. By 1523 Stockholm was taken, and Sweden delivered from the Danish yoke. At a great diet held at Strengnas in that year Gustavus was elected king of Sweden. Finland was speedily recovered. After liberating his country, Gustavus set himself to the far harder task of reforming and settling it. Sweden was in a very backward and disorderly condition. The nobles had great power and many selfish privileges; the clergy were wealthy, and in the war of freedom had taken the side of the Danes; the peasants were poor and discontented. There was little respect for law; the whole country was demoralized and disorganized. The reforms of Gustavus began with the church. The two brothers Peter-son had already introduced the doctrines of Luther, and the chancellor, Anderson, had translated the New Testament into the native tongue. Vasa encouraged their efforts; in a great diet held at Westeras, in 1527, he succeeded, under the threat of abdicating, in passing measures by which the lands of the bishops were placed

at his disposal, and full liberty was granted of preaching the gospel; but the support of the nobles had to be gained by a share of the spoils. The Reformation soon took deep root, but the troubles of Gustavus continued. He required to deal with a turbulent nobility; he had to beat off the exiled king of Denmark; thrice he needed to pacify a revolt in Dalecarlia; and he was forced to put forth the whole strength of his kingdom to quell a peasants' war in the south. The pretensions of Lübeck, which had given him real help in the war of freedom, and to which he owed a considerable sum of money, involved him in a war, by which he curtailed their commercial privileges. In all these difficulties Gustavus bore himself with equal energy and wisdom. In 1544 his position was so secure that the elective sovereignty was changed by the diet into an hereditary one. From this time till his death in 1560, except an unimportant war with Russia on the Finnish frontier, there was little to disturb the quiet progress of Sweden. Gustavus' home policy made an era in Swedish history. Law, order, and national spirit were encouraged and developed; schools were everywhere established, roads made, and foreign trade extended by advantageous commercial treaties with England and Holland. While he avoided a foreign war he did not neglect national defense; he left an excellent army of 15,000 men, and he created a considerable naval force. Altogether, few kings have done so much for any country as Gustavus Vasa did for Sweden. He was succeeded by his son Eric.

GUSTAVUS II., or **GUSTAVUS ADOLPHUS** (1594-1632), the hero of Protestantism in the Thirty Years' War, and the first king of Sweden who played a great rôle in European history, was the grandson of Gustavus Vasa, and the son of Charles IX. He was born at Stockholm in 1590, and received an excellent education. As we learn from his friend and chancellor Oxenstierna, he gained in his youth "a complete and ready knowledge of many foreign languages, so that he spoke Latin, German, Dutch, French, and Italian as purely as a native, and besides had some foretaste of the Russian and Polish tongue." Even during his busier years, after ascending the throne, it is said that he was fond of reading the great work of Grotius, *De Jure Belli et Pacis*; also that he knew Greek, preferring Xenophon as a military historian to any other. He was introduced to the business of government at an early age; when he was only ten, his father required his presence at meetings of council and at the audiences given to foreign ambassadors. This early experience was needed, for, his father dying in 1611, he ascended the throne of Sweden in his eighteenth year. His position was a difficult one; after fifty years of civil strife, Sweden had lost the strong and compact organization which it had received from Gustavus Vasa; the finances were exhausted, the nobles were discontented, and the spirit of the people had declined. Abroad, Sweden was surrounded with enemies, Denmark, Russia, and Poland being in a state of chronic hostility with it.

To the difficult task before him the young king applied himself with equal skill and resolution. The administration was reformed in all its branches, industry encouraged, and education greatly improved. In this way the national spirit was wonderfully raised; and Sweden was gradually prepared to play for the first time a great part in Europe—a part which seemed so disproportionate to her natural resources. At his accession Gustavus was engaged in a difficult war with Denmark, which, besides its supremacy over Norway, occupied what is now southern Sweden. The peace of 1613 left their respective frontiers very much as they had been before the war. The war with Russia ended much more advantageously for Gustavus in the peace of Stolbova

(1617), by which Sweden was confirmed in the possession of the Baltic provinces stretching from Finland to Livonia. Gustavus clearly foresaw the advantage to Russia and the danger to Sweden if the former power were allowed to plant itself on the Baltic coast; and he now congratulated his country on a peace which assured her against such a risk. In 1620 Gustavus married a sister of the elector of Brandenburg, with whom he lived happily till his death. After being for many years engaged in an intermittent war with Poland, Sweden (1621) entered upon a more active conflict with that power, which lasted till 1629. Sigismund, king of Poland, was his cousin, and had at one time been king of Sweden, but had been forced to resign owing to his Catholic opinions. He still laid claim to the crown of Sweden. In this war Gustavus took Riga, and made many other conquests in Livonia as well as in Courland and Prussia, part of which he retained by the peace of Altmark, concluded under the mediation of Richelieu.

While Gustavus had been involved in his Baltic war, the Catholic house of Austria had been swiftly raising itself on the ruins of German Protestantism to a position of absolute supremacy. In this early period of the Thirty Years' War, which dates from 1618, the armies of Protestantism had been everywhere overthrown by Tilly and Wallenstein. The latter, raising a host at his own cost and bearing desolation wherever he went, garrisoned Brandenburg and Pomerania, occupied Mecklenburg, and overran the continental dominions of Denmark. The only town that successfully resisted the imperial general was Stralsund; the king of Denmark was obliged to make peace. Such a colossus, with its gigantic force of oppression and devastation and its invincible armies, Gustavus now ventured to attack. It seemed a foolhardy undertaking which excited the laughter of his enemies, when in midsummer, 1630, he landed on the coast of Pomerania with his little army of 15,000 men. Yet there were many things in his favor—the despair of the Protestant princes, who saw a great part of their lands threatened by the edict of restitution; the disunion of the Catholics, who forced the emperor to dismiss Wallenstein shortly after the landing of Gustavus; the help of Richelieu, who now inaugurated the French policy of weakening Germany by dividing it. This help was formally assured him by the treaty of Bärwalde (January, 1631). Yet the German princes showed no haste to join Gustavus; the duke Boguslav reluctantly consented to receive the Swedish army into his capital—Stettin. But the marvelous discipline of the Swedes, so different from the wild barbarism of the imperial army, soon gained the confidence of the German people; robbery and license were unknown; morning and evening the soldiers assembled for prayer round their regimental chaplains; such an army had never been seen in Europe. It was not less distinguished for its hardy bravery in war; keeping the field in winter as well as summer, it soon drove the imperialists out of Pomerania and the lower basin of the Oder, and stormed Frankfort-on-the-Oder. In the midst of those successes, Gustavus was greatly moved by the sack of Magdeburg (May, 1631). Fearful of being cut off from his base of operations, he could not advance to the relief of the city without the coöperation or consent of the electors of Brandenburg and Saxony. During the delay thus caused, Magdeburg was taken by Tilly, and became a scene of the most fearful atrocities. Too late Gustavus forced the elector of Brandenburg to hand over to him the fortresses required; a desolating invasion of Saxony by Tilly compelled even the Saxon elector to seek the aid of Sweden. The union of the Swedish and Saxon forces was followed by the battle of Breitenfeld (near Leipsic), in which

Tilly was completely overthrown, and the supremacy of Catholic Austria shattered at a single blow (September, 1631). While the Saxons overran Bohemia, Gustavus, now hailed as the liberator of Protestantism, marched westward toward the Rhine, gathering round him the friendly Germans, and driving out the imperial garrisons. Würzburg and Frankfurt were occupied; at Oppenheim he forced the passage of the Rhine against the Spaniards; he spent Christmas in the ecclesiastical city of Mainz. Early next spring he advanced into Bavaria, forcing the passage of the Lech in the face of Tilly (who was mortally wounded). Munich had to pay a war contribution to the Swede.

In this overwhelming reverse of fortune, the emperor Ferdinand was obliged to invoke the aid of Wallenstein, who soon changed the course of the war. He gathered a mighty host, cleared the Saxons out of Bohemia, and, marching westward, threatened the wealthy city of Nuremberg. Afraid of a repetition of the horrors of Magdeburg, Gustavus hastened northward, and threw himself into the city with a small force. In the neighborhood Wallenstein threw up a fortified camp, resolving to starve his rival out; and here the great captains watched each other for several weeks. After drawing his scattered forces together, Gustavus offered battle to the enemy, and, when that was declined, assaulted his intrenched position, but without effect. Leaving a sufficient garrison to defend the exhausted city, he advanced a second time into Bavaria, where he hoped to draw Wallenstein after him, and thus transfer the seat of war to the enemy's country. But Wallenstein made a desolating march through Thuringia into Saxony, which he resolved to make his winter quarters; and again Gustavus was obliged to leave his Bavarian conquests to save his ally from such a cruel guest. On a misty November day (1632) he attacked the army of Wallenstein at Lützen (near Leipsic). The numbers engaged were not great; according to Ranke, the Swedes were 14,000, the imperialists only 12,000 at the beginning of the conflict; but the battle was one of the fiercest recorded in history. The Swedes had carried the strong positions of the enemy and turned his own cannon against him, when the cavalry of Pappenheim, which had left the main army shortly before the battle, appeared on the field. The Swedes were hurled back, and the king, too eagerly hurrying forward to re-form the battle, was separated from his guards and shot. Wild with rage and sorrow, the Swedes renewed the attack, overthrew the enemy, and won his artillery again. Without making any effort to recover it, Wallenstein retreated into Bohemia, while the Swedes carried the disfigured body of their king from the battlefield. It was laid to rest in the Riddarholm church at Stockholm.

GUSTAVUS III. (1746–1792), king of Sweden, succeeded his father Adolphus Frederick at the age of twenty-five. He was in Paris when his father died, and was an enthusiastic admirer of everything French. His manners were popular; he was brave, resolute, and eloquent. At the beginning of his reign he found the royal power completely overshadowed by the nobles, who in the council virtually dictated the government of the country, and had involved it in frequent disturbance and disgrace. A revolt, contrived for the purpose by one of his adherents, gave Gustavus a pretext for marshaling his guards, whom he won over and employed to make a complete change in the constitution. In many respects Gustavus made an excellent use of his great power; he improved the army and navy, reformed the administration of justice, abolished torture, and built hospitals. But his foolish aping of French fashions, and his dream of reviving the knightly exercises and accomplishments, led him into great extravagance.

In 1788, in his campaign against Russia, several nobles, officers of his army in Finland, refused to carry on the war because it had not been sanctioned by the estates. Angry at this Gustavus summoned the hardy Dalecarlians to his aid, deprived the nobles of their exclusive privileges, and made his power absolute. He continued the Russian war with success till the peace of 1790, which made no change on the Finnish frontier. Gustavus' next project, which he prosecuted with his usual energy and disregard of consequences, was a war to save King Louis XVI. from the Revolution. This war, the estates, already weary of his expensive undertakings, refused to support. To avert a new *coup d'état* some nobles formed a conspiracy against him; and Ankarström, formerly an officer in the guard, shot him at a masked ball at Stockholm (1792).

GUSTAVUS IV. (1778-1837), king of Sweden, was son of the preceding. He was only fourteen years of age when his father was cut off, and his uncle, Duke Charles, acted as regent during the minority. Gustavus early gave proof of an obstinate strength of will and of a highly wrought temperament bordering on insanity. Thus he went to St. Petersburg, according to agreement, to marry a granddaughter of the empress Catherine, and the whole court was assembled for the ceremony. The bridegroom, however, did not appear, and the company dispersed after waiting several hours. Gustavus had drawn back at the eleventh hour, refusing to sign the marriage treaty because it bound him to grant his future queen the free exercise of her religion. He spent his whole reign under the mastery of a fixed idea, that Napoleon was the Great Beast spoken of in the Apocalypse; and he joined the great coalition of 1805 against the conqueror. In this war Swedish Pomerania was occupied by the French. Even after Tilsit, Gustavus prosecuted the war with unbroken resolution. Sweden suffered fearfully by this obstinacy of the king; the Russians conquered Finland; the Danes invaded the southern provinces; his English allies, wearied of his irrational obstinacy, left him to his fate. Sweden also grew sick of his wrong-headed policy. The officers of the army conspired against him. He was dethroned and detained in captivity, while his uncle Duke Charles was elected to the crown (1809). After the new arrangements had been made, he was banished with the assurance of a considerable income. Under the name of Colonel Gustavson he passed a wandering life abroad, dying at St. Gall in 1837.

GUSTAVUS ADOLPHUS UNION, a society formed of members of the Evangelical Protestant churches of Germany, which has for its object the aid of feeble sister churches, especially in Roman Catholic countries. The project of forming such a society was first broached, in connection with the bicentennial celebration of the battle of Lützen, on November 6, 1832; a proposal to collect funds for a monument to Gustavus Adolphus having been agreed to, it was suggested by Superintendent Grossman that the best memorial to the great champion of Protestantism would be the formation of a union for propagating his ideas.

GÜSTROW, the chief town of the Wendian circle of the grand duchy of Mecklenburg-Schwerin, Northern Germany, is situated on the Nebel and on the railway from Lübeck to Stettin, twenty miles south of Rostock. Population (1890) 12,000.

GUTENBERG, JOHN, was born about 1410 at Mainz. In 1420 the citizens of Mainz drove the patricians out of the city, and as Gutenberg's name appears about ten years later at Strasburg, the family probably took refuge there. When the expelled families were recalled to Mainz, Gutenberg did not avail himself of the privilege. We next hear of him at Strasburg, where in 1434 he

seized and imprisoned the town clerk of Mainz for a debt due by the corporation of that city, releasing him, however, at the urgent representations of the mayor and counselors of Strasburg. In 1437 Gutenberg was sued before the ecclesiastical court by Emmeline zu Iserne-Thüre for breach of promise of marriage, the case being settled by his making her his wife. The active mind of Gutenberg had adopted several plans for making money before he invented the art of printing with movable types, which is his great claim upon the gratitude of mankind. Before 1425 he engaged in some experiments requiring money, when Andrew Dritzehn, a fellow-citizen became security for him. In 1438 was arranged a partnership between Gutenberg, Andrew Dritzehn, Andrew Heilmann, and Anton Heilmann, and that this concerned the new art of printing appears from the long law proceedings which soon after followed. The action was brought by the brothers of Dritzehn, who was dead, to force Gutenberg to reveal the secrets of the partnership. The decision was in favor of Gutenberg. In January, 1441, Gutenberg obtained eighty livres by mortgaging some house property, and again in 1442 he borrowed money of Martin Brether for carrying on his experiments. For four years after this nothing is known of Gutenberg except that his wife paid taxes in his name. He returned to his native city, Mainz, where he borrowed 100 guilders of his kinsman Arnold Gelthus, and established himself in the house Zum Jungen, which was part of the family possessions. At this time Gutenberg must have been able to show some solid and convincing results of his new invention, for he obtained substantial aid from a shrewd goldsmith, John Fust or Faust, who advanced 800 guilders to promote the work, taking as security a mortgage on all the printing materials to be purchased. Gutenberg at once set to work upon a large folio Latin Bible, the printing of which was ended before August, 1455. During the progress of this great undertaking several forms of indulgence and other small things were printed, the earliest with a date being the Indulgence of 1454 in the library at Althorp. But the new art was not a success commercially and again Fust had to come forward with another 800 guilders to prevent a collapse. In November, 1455, Fust determined to dissolve his connection with Gutenberg, and demanded payment of his advances. Gutenberg not being able to refund so large a sum, Fust took legal proceedings against him, and he was eventually compelled to yield up the whole of the printing materials, which at once were removed by Fust to his own house at Mainz. Here with the assistance of Peter Schöffer he continued to print until the sack of the city in 1462 by Adolphus II. Gutenberg, now in the evening of life, had to make a fresh start in the world, and fortunately in Doctor Humery of Mainz found a friend who assisted him with capital. Embarrassment, however, still pursued him, and the press made slow progress. It is uncertain whether the new press of Gutenberg was in Mainz or at the neighboring town of Eltvill. On January 17, 1465, Gutenberg accepted the post at the court of Archbishop Adolphus, of salaried courtier. He received annually a suit of livery together with a fixed allowance of corn and wine. Meantime the printing materials were lent to the brothers Bechtermunze, who printed some inconsiderable works, and upon the death of Gutenberg were claimed and taken by Doctor Humery. On February 2, 1568, died Gutenberg, poor, childless, and almost friendless, after laying the foundations of an art which was soon to dominate the world. Arnold Gelthus erected a monument to his memory near his grave, and forty years after Ivo Wittig set up a memorial tablet at the legal college in Mainz.

No portrait of Gutenberg is known, those appearing

upon medals, statues, or engraved plates being all fictitious.

GUTHRIE, THOMAS, Scottish clergyman and philanthropist, was born at Brechin, Forfarshire, on July 12, 1803. He entered the university of Edinburgh at the early age of twelve (November, 1815), and continued to attend classes there for more than ten years. During that period he seems to have read widely in general literature, although he did not distinguish himself as a student in the strict sense. On February 2, 1825, the presbytery of Brechin licensed him as a preacher in connection with the Church of Scotland; but it was not till 1830 that he was inducted to his first charge, Arbirlot, in Forfarshire, where he labored for seven years. In 1837 he became the colleague of the Rev. John Sym in the pastorate of Old Greyfriars, Edinburgh, and at once attracted notice as a great pulpit orator. Toward the close of 1840 Guthrie was chosen minister of St. John's church, Victoria street, Edinburgh. His increasing popularity brought him flattering invitations both from London and from India; but these he firmly declined. He was an enthusiastic supporter of the movement which led to the disruption of 1843; and his name is thenceforth associated with the Free church. In 1847 he began the greatest work of his life by the publication of his first *Plea for Ragged Schools*. A ragged school was opened on the Castle Hill, which has been the parent of many similar institutions elsewhere. Guthrie insisted on bringing up all the children in his school as Protestants; and thus he made his ragged schools not only educational but proselytizing institutions. This interference with religious liberty led to some controversy; and ultimately those who differed from Guthrie founded the United Industrial School, which is managed on the principle of combined secular and separate religious instruction. In April, 1847, the degree of D.D. was conferred on Guthrie by the university of Edinburgh; and in 1850 Dr. Hanna, the biographer of Dr. Chalmers, was inducted as his colleague in Free St. John's Church.

In 1864 he resigned public work as pastor of Free St. John's (May 17), although his nominal connection with the congregation ceased only with his death. Guthrie had occasionally contributed papers to *Good Words*, and, about the time of his retirement from the ministry, he became editor of the *Sunday Magazine*, contributing several series of papers which were afterward published separately. In 1865 he was presented with \$25,000 as a mark of appreciation from the public. His closing years were spent in retirement; he died at St. Leonard's-on-Sea, February 24, 1873.

GUTHRIE, the leading city in the territory of Oklahoma, is situated on the Cimarron river, and on the Atchison, Topeka and Santa Fé railroad, and though its settlement is of comparatively recent date, the city has attained to remarkable growth and development. Two daily papers are regularly published, and the commercial interests and manufacturing industries are steadily increasing in volume and importance. The city contains manufactures of lumber, ice, sash, doors and blinds, etc., a very large number of supply stores, warehouses, hotels, etc., and has become a prominent point in the territory for the investment of capital and the location of business enterprises. The present (1890) population is 5,511.

GUTSMUTHS, JOHANN CHRISTOPH FRIEDRICH, a German teacher and the principal founder of the German school system of gymnastics, was born at Quedlinburg, August 9, 1759. He was educated at the gymnasium of his native town and at Halle university;

and in 1785 he went to Schnepfenthal, where he taught geography and gymnastics in Salzmann's academy. His method of teaching gymnastics was expounded by him in various hand-books; and it was chiefly through them that gymnastics very soon came to occupy such an important position in the school system of Germany. He also did much to introduce a better method of instruction in geography. He died May 21, 1839.

GUTTA PERCHA (GUTTA TABAN, etc.) This name is applied to the concentrated or inspissated juice of various plants belonging to the natural order *Sapotaceæ*, growing in the Malay Peninsula.

The *Dichopsis Gutta* attains a height of sixty to eighty feet with a diameter of two to four feet. The leaves are obovate-oblong and entire, pale green on the upper side, and covered beneath with short reddish-brown shining down. The flowers are arranged in clusters of three or four in the axils of the leaves. The fruit, about an inch long, is of an ovoid shape, and is eaten by the Malays. In Siák (Sumatra) a vegetable butter is prepared from the seeds. The wood is soft, fibrous, spongy, and of a pale color, and marked with black lines, these being reservoirs of gutta percha. The gutta, as it flows from the tree, is of a grayish hue, occasionally with a somewhat roseate tinge, probably arising from the color vessels of the bark becoming ruptured through surcharge, and their contents mixing with the gutta. This species does not furnish all the gutta percha of commerce; indeed there are other trees which yield larger quantities. In all there are about thirty varieties known; but some of the vernacular names in different districts may prove mere synonyms.

The geographical distribution of the trees producing gutta percha is very restricted. Many of the best varieties are found only on the hill slopes at a distance from the sea-coast, each variety forming a separate grove of from 200 to 500 trees, with high forest trees above them. They grow best in a rich light loam, with a rocky subsoil.

The collection of gutta percha generally takes place directly after the rainy season, as in the dry season the gutta does not flow so readily, while during the rains ague and jungle fever are most prevalent, and the gutta is liable to be washed away from the felled trees. The yield of a well-grown tree of the best variety is from two to three pounds of gutta percha, such a tree being about thirty years old, thirty to forty feet high, and one and half to three feet in circumference. A full-grown tree sometimes measures 100 to 140 feet to its first branches, with a girth of twenty feet at a distance of fourteen feet from the base, and may yield fifty to sixty pounds of gutta percha, which loses in six months about 35 per cent. of its weight in drying.

The methods of extracting the gutta percha are much the same among the Malays, Chinese, and Dyaks. The trees are cut down just above the buttresses, or *bannes*, as they are called.

When the tree is felled, the branches are speedily lopped off, to prevent the ascent of the gutta to the leaves. Narrow strips of bark, about an inch broad and six inches apart, are then removed, but not all round the tree, as its underpart in its fall becomes buried in the soft earth, much sap being thus lost. Some natives beat the bark with mallets to accelerate the flow of milk or gutta. The milk flows slowly (changing color the while), and rapidly concretes, and, according to its source, may vary from yellowish-white to reddish or even brownish in hue. The gutta as it flows is received into hollow bamboos, doubled-up leaves, spathes of palms, pieces of bark, cocoa-nut shells, or in holes scraped in the ground. If the quantity obtained is small, it is prepared on the spot by rubbing it together in the

hands into a block, in one end of which a hole is made to carry it by. In this state it is known in the market as "raw gutta" or "guttah muntah." If water gets mixed with the juice, the gutta becomes stringy, and is considered deteriorated, but after boiling appears quite as good. Sometimes the gutta is kept in a raw state for a month or two, and then undergoes the next step in the preparation, that is, boiling. The boiling is generally conducted in a "kwali" or pan of cast or hammered iron, of about fifteen inches in diameter and six inches deep. The boiling is either simply with water, or with the addition of lime juice or cocoa-nut oil. If one pint of lime juice be added to three gallons of gutta juice, the latter coagulates immediately on ebullition.

On arriving at the port of shipment, the gutta undergoes examination and classification into parcels, according to quality. As received in the "godowns" or warehouses, it presents great diversities in condition, shape, size, and color—from crumbling, hardly coherent, whitish or grayish "raw" or "guttah muntah" fragments, to reddish or brownish blocks as hard as wood. The price ranges from 4d. to 3s. per lb.

Gutta percha, as received in foreign ports, is in irregular clumps or blocks, and is frequently adulterated with massive stones, sawdust, bark, sago flour, and other foreign matters; and the first step in its manufacture is to cleanse it thoroughly. The blocks are first sliced by means of a powerful circular wheel driven by machinery, and having fixed in it two or three strong, chisel-like knives, by which it is divided into thin slices. These are placed in wooden troughs filled with water and heated by steam. As soon as the gutta percha becomes soft, it is taken out in baskets and placed in a toothed iron cylinder, called a "deviling" machine, which tears it into fragments; these fall into a trough of water, and the impurities sink to the bottom, leaving the purified gutta floating in the form of a spongy mass. This mass is then taken out by means of perforated shovels, thoroughly washed in cold water, and dried in baskets. It is then packed in jacketed iron chests heated by steam, and left till it becomes soft, when it is at once removed, and kneaded or masticated by means of a cast-iron cylinder, with a movable lid and an internal revolving toothed iron axis,—the result being a homogeneous dough-like reddish-brown mass. Sometimes various substances are introduced into this machine, which is called a "masticator," to increase the hardness or density of the gutta, or to color it,—such as orange or red lead, chrome, vermilion, yellow ochre, sulphur, caoutchouc, gypsum, or resin, care being taken to use such substances only as are not affected by the heat necessary in the operation. The incorporation is conducted with great nicety, as at the will of the operator a soft and elastic or a hard and horny substance can be produced. When sufficiently masticated, the gutta is placed while still hot between two steel cylinders, and thoroughly rolled. By means of an endless band of felt the gutta is returned again to the cylinders, the distance between which is gradually diminished so as to compress and completely drive out any contained air from the gutta percha. There are various machines for cutting driving bands, etc., to a uniform width, and for rounding off the edges and finishing. Soles for boots are made by cutting a long strip of the requisite width, and then passing the strip under a hollow die.

In making piping a machine is used consisting of a cylinder, with a die piece attached of the requisite size. By means of a piston the gutta percha, which is introduced into the cylinder in a plastic condition, is driven through the die-piece, and the piston gives the inner diameter of the piping. As the piping issues from the machine, it passes immediately into a trough of water,

which "sets" it, and prevents it from collapsing. The value of gutta percha piping is very great; it does not contaminate water as lead piping does; it withstands insects, damp, etc., and is easily manipulated, being shortened, lengthened, or repaired without trouble or expense; and its acoustic properties have led to its employment largely in the manufacture of aural, stethoscopic, and other instruments. Gutta percha speaking tubes are now to be seen in nearly every office. The substance too, from the fact that few acids and alkalies affect it, especially if dilute, is largely employed for funnels, siphons, and other chemical apparatus.

In telegraphy gutta percha is of the very highest importance, being a cheap, lasting, and powerful insulator, easily applied to telegraphic wires. The general method of coating telegraphic wire is by charging a cylinder with plastic gutta percha, and forcing it through a die-piece, the wire forming a central core. As the wire is drawn through this "die" or "molding" piece, it becomes coated to the requisite thickness, and after passing through water it is wound on drums ready to be coated with tarred rope, and with galvanized iron wire if required for submarine cables.

The readiness with which gutta percha, while in its plastic condition, receives an impression, which it retains when cold, early led to its employment in the decorative and fine arts, since it reproduces the finest lines, as in the taking of molds from electrotypes.

GUTZKOW, KARL, one of the most distinguished of modern German novelists and dramatists, was born March 17, 1811, at Berlin. After completing his education at the Friedrichswerder gymnasium, he entered upon the study of theology and philosophy at the university of his native town, where, having had his interest awakened by the political and social questions of the time by the Paris revolution of July, 1830, he, while still a student, began his chequered literary career by the publication in 1831 of a periodical entitled *Forum der Journalliteratur*. Although the serial was a failure and was soon discontinued, it procured for him the notice of Wolfgang Menzel, who invited him to Stuttgart to assist him in the editorship of the *Literaturblatt*. At the same time he continued his university studies, first at Jena, then at Heidelberg, and latterly at Munich. In 1832 he published anonymously at Hamburg *Briefe eines Narren an eine Närrin*, and in 1833 appeared at Stuttgart *Maha-Guru, Geschichte eines Gottes*, a fantastic and satirical romance intended to ridicule the current conceptions of the divine. In 1835, on account of a difference with Menzel, he discontinued his contributions to the *Literaturblatt*, and went to Frankfort, where he became collaborateur with Duller on the *Phönix*, and also founded the *Deutsche Revue*. In the same year appeared *Wally, die Zweiflerin*, from the publication of which may be said to date the school of writers who have received the name of "Young Germany." The work was directed especially against the institution of marriage and the belief in revelation; and whatever attention it might have attracted from its own merits was tenfold increased by the action of the government, which, besides condemning its author to three months' imprisonment, decreed the suppression of all he had written or might yet write, and prohibited him from exercising the functions of editor within the states of the *Bund*. During his term of imprisonment Gutzkow employed himself in the composition of his treatise *Zur philosophie der Geschichte*, published at Hamburg in 1836, in which he opposed the Hegelian theory as to the nature and ends of history. On obtaining his freedom he went to Frankfort, where he wrote several volumes on various subjects which he published at Hamburg and Stuttgart; but finding himself hampered in

his literary undertakings by the prohibitions of the Prussian Government, he removed in 1837 to Hamburg. Here he inaugurated a new epoch of his literary activity by bringing out his tragedy *Richard Savage*, which immediately made the round of all the German theaters, and first decidedly won the ear of Germany for the modern drama. Of his numerous other plays the majority are now neglected. In 1842 Gutzkow paid a visit to Paris, of which he gave an account in *Briefe aus Paris*. After his return to Germany he resumed his stay at Frankfort, where he was chiefly occupied in preparing for the press an edition of his collected works, published in twelve volumes, 1845-46; but in 1847 he went to Dresden, where he succeeded Tieck as director of the court theater. About the same time began that period of his literary activity to which belongs the series of remarkable works of fiction intended to depict the action and tendency of the principal intellectual, social and religious forces in modern society. The chief of these novels are *Die Ritter von Geiste* (9 vols., Leipsic, 1850-52) and *Der Zauberer von Rom* (9 vols., Leipsic, 1859-61). In 1864 he had an attack of insanity, during which he made an attempt upon his life; and although after his recovery he continued to write as voluminously as formerly, his productions show henceforth decided traces of failing powers. On account of a return of his nervous malady, Gutzkow in 1873 made a journey to Italy, and on his return took up his residence in the country near Heidelberg. Although some time before his death he had been confined to his sick chamber at Frankfort, its occurrence, December 16, 1878, was due to accidental suffocation from smoke.

GÜTZLAFF, KARL FRIEDRICH AUGUST, a missionary to China, was born at Pyritz in Pomerania, July 8, 1803. In 1826, under the auspices of the Netherlands Missionary Society, he went to Batavia, where by intercourse with the Chinese residents he perfected himself in the Chinese language. He, however, severed his connection with the Netherlands Society, in 1828, and went to Singapore; and in August of the same year he removed to Bangkok, the capital of Siam, where he occupied himself in translating the Bible into Siamese. In 1829 he married an English lady, who aided him in the preparation of a dictionary of Cochlin China, but she died in August, 1831, before its completion. Shortly after her death he sailed to Macao, in China, where, and subsequently at Hong Kong, he worked at a translation of the Bible into Chinese, published a Chinese monthly magazine, and wrote in Chinese various books on subjects of useful knowledge. He also at different times undertook voyages on the coast of China, and in 1834 he published at London an account of them under the title *Journal of Three Voyages along the Coast of China in 1831, 1832, and 1833*. He died at Hong Kong, August 9, 1851.

GUY, THOMAS (1644-1724), founder of Guy's Hospital, London, was the son of a lighterman and coal-dealer at Southwark. After serving an apprenticeship of eight years with a bookseller, he, in 1668, began business on his own account. He dealt largely in Bibles, which had for many years been poorly and incorrectly printed in England. These he at first imported from Holland, but subsequently obtained from the university of Oxford the privilege of printing. Thus, and by an extremely thrifty mode of life, and more particularly by investment in government securities, the subscription of these into the South Sea Company, and the subsequent sale of his stock in 1720, he became master of an immense fortune. He died unmarried, December 17, 1724. In 1707 he built three wards of St. Thomas' Hospital, which institution he otherwise subsequently benefited; and at a cost of £18,793, 16s. he

erected Guy's Hospital, leaving for its endowment £219,499; he also endowed Christ's Hospital with £400 a year, and in 1705 built almshouses at Tamworth, his mother's birthplace, which was represented by him in parliament. The residue of his estate, which went to distant relatives, amounted to about £80,000.

GUY OF WARWICK, an old English metrical romance which is known to have existed in French as early as the end of the thirteenth century. Its authorship has been assigned to Walter of Exeter, a Franciscan monk of the thirteenth century, and, although this supposition has been generally disputed, Tanner regards it as probable.

GUYON, or GUION, JEANNE MARIE BOUVIÈRES DE LA MOTHE, a leading exponent of the quietistic mysticism of the seventeenth century, was born of wealthy parents at Montargis, department of Loiret, on April 13, 1648. From infancy a sickly and excitable child, she was at the age of two years and a half placed for a short time under the charge of the Ursuline nuns of Montargis. In her twelfth year she communed for the first time, and also began to form some acquaintance with the writings of St. Francis de Sales and of his disciple, Madame de Chantal, "la Sainte de Monthélon." In imitation of the latter, she tells us in her autobiography, that she at this time carried the name of the Saviour visibly inscribed on her person, subjected herself to severe bodily austerities, and made a solemn vow ever to aim at the highest perfection in an absolute surrender of her will to God. She wished also to take the veil, and made an attempt, by means of a forged letter purporting to be signed by her mother, to gain admission into the order of the Visitation of Mary, but her father interfered. In 1663 she removed along with her parents to Paris, where her youth, beauty and talent secured for her a very flattering reception; in the following year, before she was quite sixteen, she was married to M. Guyon, a man of some wealth and position, but of weak health, and twenty-two years her senior. It was in her twenty-first year, on July 22, 1668, she tells us, that, after much reading of Thomas à Kempis, St. Francis de Sales and other religious writers, much spiritual conversation with those who knew best about the mysteries of the "inner life" and the happiness of the state of "recollection in God," much groping in deep darkness, and much wrestling in agonized prayer, she at last experienced the change of heart which filled her with joy and peace in the life of faith. On July 21, 1676, she was left a widow, with three surviving children — two sons and an infant daughter — and began to live a life of still deeper seclusion and isolation than before, interesting herself, however, in works of charity, and in the education of her family.

Gradually, in the course of 1681, she had almost, though with hesitation, reached the conclusion that she was called to active religious work in that part of France and Savoy which borders on Geneva, if not Geneva itself; and finally she fixed her abode at Gex under the spiritual care of D'Aranthon, by whom La Combe was assigned to her as her director in the place of Bertot, who had died some time before. Here she at once began her benevolent labors, tending the sick and poor, praying with them and giving them religious instruction. The alienation of the bishop made her stay at Gex far from comfortable; and, at the close of a residence of rather more than six months, she removed early in 1682 to Thonon, apparently in the expectation of being near her adviser La Combe. Here she remained for upward of two years. Meanwhile her doctrines of "pure love" and of that "fixed state," which consists in the complete identification of the human will with the will

of God were taking more definite shape; and in 1683 they first found literary expression in *Les Torrens*. Although Madame Guyon was not herself conscious of any disharmony with the teaching and practice of the Catholic Church, her doctrines could hardly fail to be regarded by the ordinary orthodoxy of that time as more or less hostile to the generally accepted views as to the nature and mode of sanctification, and as to the normal state of the graciously renewed heart; at Thonon they soon gave deep offense, and ultimately it was intimated both to her and to La Combe, on the part of Bishop D'Aranthon, that both must leave the diocese. Her next resting place for a few weeks was Turin, whence, in the autumn of 1684, she removed to Grenoble. Nice, Genoa, and Vercelli (where she again met La Combe) were visited in turn; but it was finally resolved that Paris now offered itself as the field of labor most suited to her powers. Here accordingly she arrived on July 22, 1686, and soon she and her teaching began to meet with a very favorable reception in the higher circles of society. Meanwhile the doctrine of Molinos and the *Guida Spirituale* had been formally condemned by the Inquisition at Rome, and the sentence had been taken up as a signal, especially in France, for the persecution of all suspected quietists. In October, 1687, La Combe was suddenly arrested by a royal "lettre de cachet" and committed to the Bastille; and by the same authority Madame Guyon herself was, three months later (January 29, 1688), ordered to be detained as a prisoner in the convent of St. Marie in the Faubourg Sainte Antoine. The charges brought against her were the maintenance of heretical opinions; the holding of private religious assemblies, contrary to the practice and rules of the Catholic Church, for the spread of these opinions; the publication of a dangerous book containing opinions similar to those of the *Spiritual Guide* of Molinos; and correspondence with Molinos. These, however, were not destined to come to a definite issue, for, through influence which friends succeeded in bringing to bear upon Madame de Maintenon, a release was obtained in the following October. Madame Guyon went to live with her daughter, who had become the Comtesse de Vaux; but while on a visit with the duchess of Charost she became acquainted with Fénelon, and a considerable correspondence began. Her influence continuing to make itself felt at Paris, Dijon, Versailles, and other places, especially in the institution of St. Cyr, founded by Madame de Maintenon in 1686, the attention of theologians was drawn afresh to the "new spirituality," as it was called; and among others both the Port-Royalist Nicole and Bossuet, bishop of Meaux, sought personal interviews. Rumors prejudicial not only to the orthodoxy of Madame Guyon's faith, but also to the purity of her life, caused great scandal in the highest quarters, so that at last she was constrained to write to Madame de Maintenon requesting that a number of suitable persons might be selected for the purpose of judging both of her doctrine and her morals. A commission was duly nominated, consisting of Bossuet, Bishop (afterward Cardinal) De Noailles, and Tronson, the superior of St. Sulpice. To this tribunal she at their request submitted the *Moyen Court*, *Les Torrens*, and the manuscripts of her commentaries along with her autobiography, to which she added her *Justification*. The outcome of many deliberations, extending over some months, was the preparation of twenty-four articles, usually called the "Articles of Issy," relating to the doctrine of "pure love." Her refusal to sign a "condemnation of religious errors," as drawn up and presented to her by Bossuet in a pastoral ordinance and letter, now led to an open rupture which resulted in her reimprisonment, on this occasion at Vincennes, on December 27, 1695. She

was not released until 1702, in which year she was banished to Blois, where the remainder of her life was spent. She heard mass daily, received the sacrament every alternate day, and died in full communion with the Roman Catholic Church, after an illness of three months, on June 9, 1717.

GUYTON DE MORVEAU, LOUIS BERNARD, BARON, a distinguished French chemist, was born January 4, 1737, at Dijon. He obtained in his twenty-fourth year the office of advocate-general in the parliament of Dijon, of which he fulfilled the duties till 1782. In 1772 he published at Dijon the *Digressions Académiques*, in which were set forth his views with respect to phlogiston and the phenomena of crystallization; and in 1773 he discovered the efficacy of hydrochloric acid gas as an atmospheric disinfectant. He was the means, in 1774, of founding in Dijon courses of public lectures on mineralogy, materia medica, and chemistry, the last of which he himself during thirteen years gratuitously delivered. In 1777-78 appeared the *Éléments de Chymie Théorique et Pratique* (3 vols. 12mo) of de Morveau, Maret and Durande, a work highly appreciated by their contemporaries. The chemical articles in vol. i. of the section "Chymie, Pharmacie, et Metallurgie," of the *Encyclopédie Méthodique* (1786), as also some few of those of vol. ii. (1892), were from the pen of De Morveau.

De Morveau's first essay on a new chemical nomenclature was published in the *Journal de Physique* for May, 1782, and was the subject of much adverse criticism. Repairing to Paris, the author successfully met the objections of his opponents; and in 1787, in conjunction with Lavoisier, Berthollet and Fourcroy, he published *Méthode d'une Nomenclature Chimique*, the principles of which were speedily adopted by chemists throughout Europe. The first manufactory of carbonate of soda in France was established by De Morveau in 1783. In 1791 he represented the department of Côte d'Or in the legislative assembly, and next year in the national convention, of which he was reelected a member in 1795. Having already become famous for aeronautical experiments at Dijon in 1783-84, he was appointed in 1794 to superintend the construction of balloons for military purposes. About the same time he rendered important service to his country by perfecting the processes for the manufacture of gunpowder and saltpeter. In 1796 De Morveau was made a member of the institute. He retired from political life in 1797, and in 1798 became provisional director of the Polytechnic School, in the foundation of which he had been actively concerned. He held during 1800-14 the appointment of master of the mint, received in 1803 the cross of the legion of honor, and was made in 1805 an officer of the same order, and in 1811 a baron of the French empire. He died January 2, 1816.

GUZERAT or GUJARÁT, the name given to the northern seaboard of the Bombay Presidency, extending from 20° to 24° 45' N. latitude, and from 69° to 74° 20' E. longitude. It is to the northern part of the presidency what the Konkan is to the south, and is bounded on the north by Rájputáná, on the east by the spurs of the Vindhya and Sátpurá ranges, on the south by the Konkan, and on the west by the sea. On the mainland it comprises the British districts of Surat, Broach, Káira, Páñch Maháls, and Ahmedábád, with a total area of 10,082 square miles, and a population (1890) of 3,000,000; together with the great but scattered territories of the Gaikwar of Baroda, and also the native states of the Mahi Kánta and Rewá Kánta agencies, Palanpur, Radhanpur, Balasinor, Cambay, Dang, Chaurar, Bansda, Peint, Dharampur, Tharad, Sachin, Wasravi, etc. The term Guzerat is sometimes em-

ployed to include the peninsula of Káthiáwár, with its 180 petty states. The total area, inclusive of the peninsula of Káthiáwár, is 41,536 square miles. For an account of the history, geography, etc., of Guzerat, see the articles on the various states and districts. Guzerat gives its name to the vernacular of northern Bombay, viz., Gujaráthi, one of the three great languages of that presidency.

GUZMICS, IZIDÓR, Hungarian theologian and scholar, was born April 7, 1786 at Vámos-Család, in the county of Sopron, and died September 1, 1839.

GWALIOR, a native state in political relationship with the Central India Agency and the Government of India. The state consists of several detached districts, the principal of which is bounded on the northeast by the Chambal river, dividing it from the British districts of Agra and Etáwah, on the east by Bundelkhand and Sagar (Saugor) districts, on the south by the states of Bhopal and Dhar, on the west by those of Rajgarh, Jhaláwar and Kotah, and on the northwest by the Chambal, separating it from Karauli (Kerowlee), and Dholpúr in Rájputáná. The area, including part of the ancient province of Agra and most of Malwa, is 33,119 square miles. The Sind, with its tributaries the Kuwári, Asar, Sankh and other smaller streams, flows through the state. The chief products are opium, known as Malwa opium, wheat, gram, pulses of various kinds, *joár*, *bájra*, *mug*, maize, rice, linseed and other oil-seeds, garlic, tumeric, ginger, sugar-cane, indigo, *al* yielding a fine red dye, tobacco, and cotton. Many species of wild beasts and birds are found throughout the state. The rivers abound in fish, especially of the carp kind.

Burhánpur is the site of a considerable manufacture of fine cottons, silks, and rich brocades. Iron ore is raised and smelted in many places. The principal imports are British woolens, cottons, silks, cutlery, cashmere shawls, pearls from the Persian Gulf, Ceylon diamonds, and agates from Bundelkhand, gold, silver, mercury, copper, lead, and zinc. The chief exports are opium, cotton, tobacco, dyes, and iron. The Indore and Ajmere narrow-gauge railway, built in 1879, passes through the west of Gwalior state, while a railway on the broad gauge, connecting Gwalior town with Agra, has been completed.

During the hot and dry seasons the climate is not unhealthy, but during the rainy season fevers prevail, especially in the north. The range of the thermometer is unusually small, except during the sultry season, when it sometimes rises to nearly 100° during the day. The average rainfall during the rainy season is fifty inches.

The population of the northeastern part of this territory is of many elements, comprising, besides Marhattás, (the ruling race), Bundelas, Játs, and Rájputs, with some less distinctly defined divisions of Hindus and Mahometans. There is perhaps no part of India where the tribes of Bráhmans are so various and their number so great as in the southern and southwestern parts. The Mahometan population is estimated at about a twentieth of the whole. Including the cessions to Sindhia under the treaty of 1860, the territories of the Gwalior state were in 1890 estimated to contain a population of about 2,700,000.

GWALIOR, the capital of the Gwalior state, and fortress residence of the Mahárájá Sindhia, sixty-five miles south from Agra, and 277 northwest of Allahábád. Gwalior city has a threefold interest—first, as a very ancient seat of Jain worship; secondly, for its example of palace architecture of the best Hindu period (1486-1516), and thirdly, as the fortress capital of one of the greatest native chiefs of India.

There are several remarkable Hindu temples in Gwalior. One, known as the Sas Báhu, understood to be of Jain erection, is beautifully adorned with bas-reliefs, and is now resorted to both by the Vaishnav and Siva sects. It was finished in 1093 A.D., and, though much dilapidated, still forms a most picturesque fragment.

The palace built by Mán Sinh (1486-1516) forms the most interesting example of early Hindu work of its class in India. Another palace of even greater extent was added to this one in 1516; both Jahángír and Sháh Jehán added palaces to these two—the whole making a group of edifices unequalled for picturesqueness and interest by anything of their class in Central India. Among the apartments in the palace was the celebrated chamber, named the *Báradári*, supported on twelve columns, and forty-five feet square, with a stone roof, forming one of the most beautiful palace halls in the world.

The fort of Gwalior stands on an isolated rock. The face of the fort is perpendicular, and where the rock is naturally less precipitous it has been scarped. Its greatest length from northeast to southwest is a mile and a half, and the greatest breadth 300 yards. The rock attains its maximum height of 342 feet at the northern end. A rampart, accessible by a steep road, and farther up by huge steps cut out of the rock, surrounds the fort. The citadel stands at the northeastern corner of the inclosure, and presents a very picturesque appearance. The old town of Gwalior, which is of considerable size, but irregularly built, and extremely dirty, lies at the eastern base of the rock. It contains the tomb of Muhammad Ghaus, which was erected during the early part of Akbar's reign. The fort of Gwalior, according to Wilford, was built in 773 A.D., by Surya Sen, the rájá of the neighboring country.

GWILT, JOSEPH, author of the *Encyclopædia of Architecture*, was born at Southwark, January 11, 1784. In 1811 he published a *Treatise on the Equilibrium of Arches*, and in 1815 he was elected a fellow of the Society of Antiquaries of London. After a visit to Italy in 1816, he published in 1818 *Notitia Architectonica Italiana, or Concise Notices of the Buildings and Architects of Italy*. In 1825 he published, with notes and valuable additions, an edition of Sir William Chambers' *Treatise on Civil Architecture*; and among his principal other contributions to the literature of his profession are a translation of the *Architecture of Vitruvius* (1826), a *Treatise on the Rudiments of Architecture, Practical and Theoretical* (1826) and his valuable *Encyclopædia of Architecture* (1824), which has passed through a great many editions, and was published with additions by Wyatt Papworth in 1867. He died September 14, 1863.

GWYNIAD is the name given to a fish of the genus *Coregonus*, inhabiting the large lakes of North Wales and the north of England.

GYARMAT, a Magyar term signifying *colony*, and applied to several places in Hungary. Of these the following two towns have the largest number of inhabitants.

BALASSA-GYARMAT, capital of the Cis-Danubian county of Nógrád, is situated on the Ipoly, about forty miles north-northeast of Budapest. Population, 6,435.

FÜZES-GYARMAT, a market-town in the Trans-Tibiscan county of Békés, is somewhat unfavorably situated in the extensive marshy tract of country known as the Sárret. Population, 5,735.

GYARMATHA, a market-town in the county of Temes, Hungary, situated in a level but productive agricultural district to the northeast of Temesvár.

GYERGYÓ-SZENT-MIKLÓS, a market town of

Hungary, in the Transylvanian county of Csik, is situated in a mountainous but well-wooded district, ninety-six miles east of Klausenburg, and about twenty-five west of the Moldavian frontier.

GYGES, founder of the third dynasty, called Mermnad, of Lydian kings, reigned about 687-654 B.C. In the reign of Candaules, Gyges, perhaps after banishment, attempted during the troubles caused by the Cimmerian invasions into Asia Minor, to gain the royal power. He was aided by foreign, especially Carian, mercenaries, but was strenuously resisted by the native population. At last it was agreed to refer the decision between the old Heraclid dynasty and the new claimant to the national god Heracles; but, to ensure impartiality they appealed to him under his Greek form of Apollo. The Delphic oracle gave its answer in favor of Gyges, and the presents with which his gratitude enriched the shrine were seen and described by Herodotus.

GYLLEMBOURG-EHRENSVÄRD, THOMASINE KRISTINE, BARONESS, the most eminent female writer of Denmark, was born November 9, 1773, at Copenhagen. Her maiden name was Buntzen. Her great beauty early attracted notice, and before she was seventeen she married the famous political writer, Peter Andreas Heiberg. To him she bore in the following year a son, afterward illustrious as the poet and critic Johan Ludvig Heiberg. In 1800 her husband was exiled and she obtained a divorce, marrying in December, 1801, the Swedish Baron Ehrensward, himself a political fugitive. Her second husband, who presently adopted the name of Gyllembourg, died in 1815. In 1822 she followed her son to Kiel, where he was appointed professor, and in 1825 she returned with him to Copenhagen. In 1827 she first appeared as an author by publishing her romance of *The Polonius Family* in her son's newspaper *The Flying Post*. In 1828 the same journal contained *The Magic Ring*, which was immediately followed by *An Everyday Story*. From this time forward she took a foremost place among the writers of her time, but preserved her anonymity with entire success. In 1833-34 she published three volumes of *Old and New Novels*. *New Stories* followed in 1835 and 1836. In 1839 appeared two novels, *Montanus the Younger* and *Ricida*; in 1840, *One in All*; in 1841, *Near and Far*; in 1843, *A Correspondence*; in 1844, *The Cross Ways*; in 1845, *Two Generations*. From 1849 to 1851 the Baroness Ehrensward-Gyllembourg was engaged in bringing out a library edition of her collected works in twelve volumes. On July 2, 1856, she died in her son's house at Copenhagen.

GYMNASIUM was the name applied by the Greeks to a building designed for the practice of physical exercises. From the earliest times we hear of athletic sports in honor of heroes and gods. Sometimes they are celebrated among the funeral rites of a deceased chiefs, sometimes they form part of a periodic festival. At first competitors exercised stripped of their outer garments (*γυμνοί*): hence arose the name gymnasium. Afterward the habit of exercising naked became universal. In the continuance of their history the Greeks grew more attached to such sports; their free active life, spent to a great extent in the open air, fostered the liking almost into a passion. The victor in any athletic contest, though he gained no money prize, was rewarded with the honor and respect of his fellow-citizens; and a victory in the great religious festival was counted an honor for the whole state. In these circumstances the training of competitors for the greater games became a public concern; special buildings and officials were provided for the purpose by the state. But, as gymnastics became more and more an institution of social life, the gymnasia were applied to other uses even more impor-

tant. The most interesting points are the connection with education on the one hand, with medicine on the other. Due training of the body and maintenance of the health and strength of children were the chief part of earlier education. Except the time devoted to letters and music, the education of boys was conducted in the gymnasia, where their moral training was as carefully attended to by special officers as their physical exercises. As they grew older conversation and social intercourse took the place of the more systematic discipline. Philosophers and sophists assembled to talk and to lecture in the gymnasia, which became places of general resort for the purpose of all less systematic intellectual pursuits, as well as for physical exercises. Plato, when treating of education, devotes much consideration to gymnastics. Gymnastic exercises proper were designed, not merely as in Sparta, to foster the taste for war and the activity and strength needed for using weapons, but also to produce graceful carriage and healthy tone of the body. According to Plato, the sophist Prodicus first pointed out the connection between gymnastics and health. Having found such exercises beneficial to his own weak health, he formulated a method which was adopted generally, and which Hippocrates improved on. The gymnasia were large buildings which contained, not merely places for each kind of exercise, but also a stadium, baths, covered porticos for practice in bad weather, and outer porticos where the philosophers and men of letters read public lectures and held disputations. In Athens there were three great public gymnasia—Academy, Lyceum, and Cynosarges—and every Greek city of consequence seems to have possessed one. Ruins of them exist at Pergamus, Ephesus, Alexandria in Troas, etc., from which, and from the accounts of Vitruvius (v. 11), it would appear that all were constructed on much the same plan. The details will be found most clearly given in Rich's. *Dictionary of Greek and Roman Antiquities*.

Gymnasium, in its modern use, generally signifies a school for gymnastic exercises, but it is sometimes used also to denote a higher school intended to give immediate preparation for the universities. The latter application of the term is specially prevalent in Germany.

GYMNASTICS, in the general acceptation of the term, denotes every exercise which tends to develop and invigorate the bodily powers, such as walking, running, riding, fencing, rowing, skating, dancing, and many others. In another sense gymnastics includes those manly and healthful games which have been encouraged by all high-minded nations as calculated to improve the physical strength and keep alive the martial spirit of their people. In a more limited sense, the term has been employed to denote the modern system of bodily exercises. Physical strength was the veritable god of antiquity, and we therefore find the elements of a system of gymnastics in most nations from the earliest times. The following considerations appear to be of great weight as supporting the views put forward by the advocates of physical education. While the national games may seem to some sufficient for the physical development of the ordinary youth and manhood of a country, it must not be forgotten that there is a vast and rapidly increasing portion of the population, especially in large cities, to whom the "national games" are quite unknown diversions, and that it is among this class that the most marked deterioration in physical development is only too apparent. The children of this class dwell cooped up in narrow, ill-lighted, and worse-ventilated courts, from which they are often dragged to undergo a certain amount of mental training, in many cases perhaps too severe to be sustained by their debilitated and enfeebled bodies.

While so much is being done for the mental culture of the rising generation, their physical culture is left very much to inclination or chance. But there is another source of danger put forward by those who advocate the sufficiency of the national games, viz., "the neglect of any classification of games at school, and allowing the weak and strong to engage in them indiscriminately, to the detriment of the physical wellbeing of the more delicate;" and they proceed to show the injury that may be done by the present system of competitive outdoor sports unregulated by judicious restraint. Acting upon the well-grounded opinion that neither mental serenity nor mental development can exist with an unhealthy animal organization, and admonished by "the sad deaths of two promising young men, and the breaking down in health of others just at the end of their college course," the authorities of Amherst College were impelled to demand that the college officials should give a proper attention to physical health as well as to the culture of those powers for which departments were ordinarily created and endowments made. In 1859 a department of physical education and hygiene was created, concerning which we read in the catalogue of 1861-2 that —

"Its design is to secure healthful daily exercise and recreation to all students; to instruct them in the use of the vocal organs, movement of the body, and manners, as connected with oratory; and to teach them, both theoretically and practically, the laws of health. This daily physical training is a part of the regular college course. The professor is an educated physician, and has not only a general oversight of the health of the college, but students have the privilege of consulting him without charge. While the gymnasium will furnish opportunities for the highest physical training, the required exercises will be such as can be performed without undue effort or risk of injury."

Each class, at a stated hour on four days of the week appears at the gymnasium, and all perform their part in systematic and methodical exercises timed to music. The statistics of this department show some interesting facts in reference to the duration of sickness among students. While the average amount of time lost on account of sickness by each laborer in Europe is found to be nineteen or twenty days each year, the returns of Amherst college sick-list for term time give 2.64 days as an annual average of time lost to every student, and 11.36 days to each sick student for seventeen years. A decrease in the amount of sickness during the course is also an important feature in the health of the college.

Considerable attention is now being paid to the best methods for improving the physical education of the people in nearly all the Continental states. The greatest activity is perhaps shown by Sweden, Germany, France, Belgium, and Italy; and even in Russia the question is attracting much public attention, Doctor Berglund having been ordered to write a special book on the subject. In Hungary also the government has made physical education an obligatory part of the school curriculum. In Prussia gymnastic instruction was formally recognized by a cabinet order of June, 1842, and by a royal order of 1862 a guide-book of gymnastic instruction was introduced into the primary schools and into the training colleges for teachers. In Sweden this subject appears to have earlier attracted attention, for in 1813 the government, under the direction of P. H. Ling, founded the Royal Central Gymnastic Institute at Stockholm, where teachers of both sexes are gratuitously trained for two years, and receive a diploma after undergoing a theoretical and practical examination. In Belgium, under the united efforts of MM. Delcour and Émile Greyson, considerable progress has been made,

although much has still to be done, owing to the opposition raised by the municipality of Brussels to the views put forward by the government. In the girls' schools the exercises are accompanied by music, after the example set by Colonel Ameros, who about the beginning of this century introduced into France a series of gymnastic exercises adapted to a jingling rhyme and to music. The chanting governed the movements, marked the intervals of repose, and helped to strengthen the organs of the voice and respiration. In France the necessity for the physical education of the people began to attract attention about the year 1845, owing probably to the energy displayed by Jahn in Prussia. M. de Salvandy proposed to introduce the teaching of gymnastics into the Lycées of Paris and Versailles, and a commission was appointed by him, which, however, never presented a report. In 1850, 1851, 1855, and 1856 several attempts were made to enforce a compulsory gymnastic training, but the principle was not accepted till 1869, when M. V. Duruy took for his basis of action the labors of the commission presided over by Doctor Hillairet.

In England we find that the first attempt to introduce scientific physical education among the people was made in parliament in 1862 by Lord Elcho. This attempt failed, as also did another made in 1875 by P. A. Taylor, M.P. for Leicester, although supported in an able speech by Mr. Butler Johnstone. Lord Sandon, then vice-president of the committee of council on education, told parliament that "the government has done all that could be expected of them for physical education by taking steps to substitute military drill for ordinary drill." The substitution, it may be remarked, does not appear to have any advantage over the drill it displaced, as the military authorities declared the ordinary military drill to be insufficient for the requirements of the soldier, and have during the last sixteen years instituted gymnasiums at Aldershot, Gibraltar, Malta, and elsewhere, the teachers in which have, for the most part, passed under the care of Mr. Maclaren of Oxford, one of the principal authorities on the subject in England. Without entering into details, it may be admitted that the physical condition of the people, if not actually deteriorating, is not improving, and it is a significant fact that within the last year or two it has been found necessary to lower the standard in the British army, and that Doctor Ord, in his report for 1869, states that out of 5,567 boys 4,410 were rejected as under the standard of width of chest and height.

Although there is some diversity of opinion among teachers of gymnastics as to the relative value of the different exercises, some holding that "free exercises" are sufficient, others that certain mechanical appliances are necessary, yet all agree that, to insure healthy and perfect development of the organs of the body, a course of gymnastics must commence with such simple exercises as walking, running, jumping, etc. The introductory course ordinarily consists of "movements and positions," and the use of dumb-bells and bar-bells. In some French gymnasiums, especially those presided over by M. Laisné of Paris, an instrument invented and called by him a "xylofer" is in use, consisting of a wooden stick strengthened and weighted with a rod of iron, and corresponding apparently to the bar-bells of English teachers. Another form of movable apparatus, also in use in some Continental schools, consists of sticks on which slide wooden spheres of from six to seven inches diameter, prevented from slipping off by india-rubber rims at each end. The movements which accompany the use of the stick are intended to expand the chest and increase the power of the muscles of the back. In stretching the arms outward from the bent

position, the spheres fly outward and very much increase the energy of the movement.

For the preliminary exercises with movable apparatus, the dumb-bell is that usually selected. It was in use in England in the time of Elizabeth. It has many advantages over the Indian club, the practice of the dumb-bell requiring a less amount of room, and not presenting the risk the club does of overstraining the body by its unskillful use.

The dumb-bell admits of being exactly proportioned to the individual strength of each learner, and can be adjusted in weight as his strength increases. The exercises, also, that may be performed with it give employment to all parts of the body and to both sides equally. The *bar* is simply a two-handed dumb-bell. Next in order come walking, running, and leaping, the exercises being so regulated that both the distance and speed are gradually increased. The *leaping rope* is suspended from a beam, and enables the leaper to clear a barrier at the same time that it gives employment to both the upper and lower limbs. The *leaping pole* is usually made of ash and varies from eight to ten feet in length. Its use may be left to the pleasure of the pupil after he has acquired some dexterity with the leaping rope.

The *horizontal beam* is a round wooden beam so mounted that it may be moved up and down. The exercises on this are chiefly balancing the body in the sitting and erect posture, and when moving along it.

The *vaulting bar* differs from the preceding in being somewhat thinner, so as to be easily grasped by the hand. The appropriate exercises on it have for their object the strengthening of the muscles of the upper extremity and loins. The *vaulting horse* allows of a wider range of exercises, and requires a greater amount of strength and dexterity. The muscles of the upper and lower limbs and trunk are all benefited by its use. The *fixed parallel bars* are used to develop the muscles of the trunk and upper limbs, but chiefly the former. The *movable parallel bars* may be used for the same exercises as the preceding. The *trapeze* consists of a horizontal bar suspended by ropes at a height of four or five feet from the floor. Considerable practice is required to perform the exercises on this machine with dexterity and neatness. The *horizontal bar*, the *bridge ladder*, the *plank*, the *inclined plane*, the *prepared wall*, and the *mast*, and several modifications of these are used.

GYMNOTUS, or ELECTRIC EEL, (*G. electricus*), the most powerful of the electric fishes, occurs in the fresh water of Brazil and Guiana. It is a type of a family Gymnotidæ among the Physostomatous bony fishes. There are no dorsal nor strictly caudal fins, but the anal fin extends on to the end of the tail; there are no scales, and the eyes are very small. The fish attains a length of 6 feet, and is capable of temporarily paralyzing a man or other large animal by its shock.

GYNÆCOLOGY (from the Greek *γυνή*, *γυναικός*, a woman, and *λόγος*), that branch of medicine which concerns the pathology and treatment of affections peculiar to the female sex. (See MEDICINE.)

GYOMA, an old market-town in the Trans-Tibiscan county of Békés, Hungary, is situated on the banks of the Körös main stream. It has a fine town-hall, Roman Catholic, Calvinist, and Lutheran churches, a Jews' synagogue, tax, post, and telegraph offices, a brewery, several elegant private residences, and a large station on the Szolnok-Arad Railway. Population about 10,000.

GYÖNGYÖS, the second town in importance of Heves county, Hungary, is situated at the foot of the Mátra, southwest of Eger (Erlau), and is connected by a branch line with the Budapest-Miskolcz royal state railway. Gyöngyös is the seat of a court of justice, and

contains three churches, a large monastic establishment belonging to the Franciscans, a gymnasium, manufactories of leather, hats, and woolen cloth, and distilleries. Population (1890), 16,000.

GYÖNGYÖSI, ISTVÁN or STEPHEN, one of the most talented Hungarian poets of the seventeenth century, was born in 1620. Of his literary works the most famous is the epic poem, *Murányi Venus* (Caschau, 1664), which hymns the praises of his benefactor's wife, Maria Szécsi, the heroine of Murány. Among his later productions the best known are—*Rózsa-Koszorú*, or Rose-Wreath (1690), *Kemény-János* (1693), *Cupidó* (1695), *Palinodia* (1695), and *Chariklia* (1700). His poems are chiefly remarkable for energy, feeling and popular sentiment.

GYPSUM, the hydrated sulphate of lime, is a mineral substance occurring in various rock formations, especially in Tertiary deposits, in very considerable abundance and under varying conditions. In its transparent crystalline state it is known as selenite; when it presents a finely fibrous opalescent appearance, it is termed satin spar; and the name alabaster is reserved for the pure milky-white massive varieties. Gypsum is very generally disseminated, the most famous locality for the finer qualities worked into alabaster vases and figures being Castelino, about thirty miles from Leghorn; while Montmartre, Argenteuil, and other places in the environs of Paris, and in the neighborhood of Derby in England, furnish inexhaustible supplies chiefly for the preparation of plaster of Paris and for agricultural use, etc. It is also found in large quantities in Nova Scotia, New York, Virginia and Michigan. The application of gypsum as a manure is referred to under AGRICULTURE, and its employment for ornamental purposes is described under ALABASTER. The preparation of plaster of Paris, so called from the fact that the industry chiefly centers in several Parisian suburbs, is the principal primary object of the quarrying or mining of gypsum. By the application of heat gypsum begins, at a temperature of about 175° Fahr., to part with its combined water. An increase of temperature causes the desiccation to proceed with great rapidity, and for manufacturing purposes the best results are obtained at from 230° to 250°. For making plaster of Paris, gypsum is burnt in kilns at about the latter temperatures, and subsequently it is powdered and ground to a fine uniform flour. So prepared it possesses the valuable property of recombining with water when mixed with it, and setting, from a thin paste, into a solid mass, the phenomenon being accompanied with some expansion and the evolution of heat. It is to this property of recombining with water that the value of plaster of Paris is principally due. Plaster of Paris is largely used for obtaining copies of statuary figures, coins, medals, sculptures, and carvings, and also for taking casts from natural objects. It is also employed as the material for molds for electro-deposits, and for the manufacture of embossed and pressed pottery ware. Still more extensively is it consumed in the finishing of internal plaster work in houses, and for making cornice moldings and other architectural enrichments in positions sheltered from the weather. A fair imitation of meerschaum is made in hardened plaster by polishing, tinting the surface with a solution of gamboge and dragon's-blood, and treating it with either melted paraffine or stearic acid. It is understood that the cheaper "meerschaum" pipes and cigar-holder are thus prepared.

GYROSCOPE, GYROSTAT, are names given to instruments which are used to demonstrate certain properties of rigid bodies, when made to rotate rapidly

about the axis round which they are kinetically symmetrical.

In some of its forms the gyroscope has been known for a long time, and it is, in all probability, of French or German invention. Almost the first instrument of the kind that we hear of, and of which the present gyroscope is merely a modification, is that of Bohnenberger, which was constructed as early as 1810, and is described in Gilbert's *Annalen* for 1818. It consisted of a heavy spheroid which could rotate inside a circular ring round its shorter axis—the axis running on pivots situated at opposite ends of the ring's diameter. This ring, with its contained spheroid, was similarly made movable inside a second ring, and round an axis at right angles to the axis of the spheroid. In the same way this second ring, with its contents, could rotate inside a third ring, and round an axis at right angles to each of the others. From this it will be seen that the spheroid had all degrees of free rotation—one point only within it being fixed, namely, the intersection of the three axes.

Under the title of precession instruments, various pieces of apparatus, involving the gyroscope principle, have been in use for a number of years for illustrating the precession of the equinoxes, and the parallelism of the earth's axis as it revolves round the sun. An instrument of this kind was given by Arago to Professor Playfair, which must have been in existence since 1816–17. Mention is made of a similar instrument as being brought from Italy to Mr. Babbage in 1827. At the close of that year a notice of an instrument akin to the gyroscope made by Mr. Henry Atkinson was read before the Astronomical Society. In 1836, in a paper read before the Royal Scottish Society of Arts, Mr. Edward Sang, C.E., Edinburgh, suggested an experiment with an instrument exactly similar to the gyroscope, by which the rotation of the earth on its axis could be directly proved. This suggested experiment was actually carried out in 1852 by M. Leon Foucault, although, in all probability, without any knowledge on his part of Mr. Sang's suggestion. Already, in 1851, Foucault, in his famous experiment with the pendulum at the Pantheon in Paris, had shown how the constancy of the plane of a pendulum's vibration could be used to show the rotation of the earth, and now, in 1852, he

applied the property of the "constancy of the plane of rotation" of a gyroscope for the same purpose. The name gyroscope was given to the instrument by Foucault at this time, and in order to perform the experiment successfully the instrument had to be constructed with the utmost exactness. The experiment was repeated at the Liverpool meeting of the British Association, and by causing a considerable sensation in the scientific world at the time, was the means of bringing the gyroscope into public notoriety.

The gyrostat is a modification of the gyroscope, devised by Sir William Thompson, which has been used by him as well as by Professor Tait for a number of years to illustrate the dynamics of rotating rigid bodies. It consists essentially of a fly-wheel, with a massive rim, fixed on the middle of an axis which can rotate on fine steel pivots inside a rigid case. The rigid case exactly resembles a similarly-shaped, but hollow, fly-wheel and axis closely surrounding the other but still leaving it freedom to move. Slits are made in the containing case whereby a cord can be coiled several times round the axis for the purpose of setting the fly-wheel in motion. There is also attached to the rigid case, in the plane passing through the center of gravity of the wheel at right angles to its axis, a thin flange of metal, which is called the bearing edge. The circumference of this flange is not a circle but a curvilinear polygon of sixteen or more equal sides. The object of making it so is to prevent the instrument from rolling like a wheel on the bearing edge when the fly-wheel is rotating rapidly.

The gyrostat is a most instructive instrument, and with it many interesting experiments can be performed.

GYTHIUM was an ancient Achæan town on the Laconian Gulf, southwest of the mouth of the Eurotas, near the site of the modern port Marathonisi. It lay opposite the island of Cranæ, at the foot of the fertile valley of the Gythius. On its coins the common types are Apollo and Heracles, the founders of the city.

GYULA, chief town of the Trans-Tibiscan county of Békés, Hungary, is favorably situated on the Fehér (White) Körös, and has a well-built station on the Nagy-Várad (Grosswardein) and Eszék line of the Alföld-Fiume Railway. Population (1890), 20,000.

H.

H has varied in form from the Phœnician and old Hebrew symbol **𐤇**, called Cheth, only by the removal of the upper and lower horizontal lines. The closed form is sometimes found in old Greek inscriptions, and, though less frequently, in South Italy.

Its value in Phœnicia was probably a continuous guttural sound — the sound which it had in Hebrew — resembling the German *ch*, and with no English counterpart. In Greece it represented nothing more than the spirant *h*, so long as a separate symbol to denote that sound was felt to be necessary. Afterward it was generally employed to denote a second *e*-sound, under the name of *Eta*; probably it had before been called *Heta*. The time of this change varied in different parts of Greece. In the alphabet of the island of Thera we find *H* representing *e* as early as the fortieth Olympiad, though it still sometimes retained its old value. At Athens the date was 403 B.C., and here the practice did not vary. But in most of the alphabets of Greece proper, of Peloponnesus, and of the Italian colonies, *H* still remained as the rough breathing; and as such it consequently passed into the Latin alphabet. It is possible that *h* in a very few Latin words, when it occurs as a medial sound (e.g., *traho*, *veho*), was a continuous guttural. But generally it occurs at the beginning of a word, and can hardly have been more than a breathing. Even as this it early became evanescent. During the classical period of Latin literature it was retained in the speech of educated men, doubtless in part by Greek influence. But in the popular speech it was rapidly disappearing as an initial sound; although it continued to be written, and indeed was often written wrongly, at the beginning of words where it had no place; e.g., *umor* was written *humor*, and the *h* has held its own in English spelling down to our day. The sound is almost completely lost in modern Italian.

HAARLEM, a city of the Netherlands, the chief town of the province of North Holland. By rail it is eleven miles west of Amsterdam, nineteen south of Alkmaar, and twenty north of Leyden. Distant about five miles from the German Ocean, it communicates with the Zuyder-Zee by the Spaarne and the IJ. The railway to Amsterdam was opened in 1839, and that to Alkmaar in 1867.

Haarlem is a typical Dutch town. The branches of the Spaarne and an extensive system of canals bring the ship-traffic into the heart of it, and turn its streets into so many quays. The roadways are paved with bricks; the houses have gable-ends with old-fashioned crow-steps; and everything wears a decent and quiet aspect, which to one man is dullness and to another "aristocratic gravity and modest coquetry." What the city lacks in liveliness it makes up by the interest of its historical associations and the number of its scientific and artistic institutions. The great market place es-

pecially has much that is worth seeing; the town-house and the cathedral of St. Bavo; the old meat market, a building of the end of the sixteenth century in the old Dutch style; the stadsdoelen, or place where in former times the burghesses used to assemble in arms; and the statue erected to Koster in 1856, when in Holland he was still generally considered the inventor of printing. St. Bavo's is one of the most famous churches in the Netherlands. It is a cruciform structure completed in 1538, and makes a considerable impression on the spectator by the great length (about 426 feet) of its main axis and the height and steepness of the roof. The tower is about 255 feet high, and there is a good deal of beauty about the perspective of its aisles. The organ, built by Christian Muller of Amsterdam between 1735 and 1738, was for some time the largest in the world, and is still celebrated for the sweetness of its tone, especially in the vox humana stop. It possesses four key-boards, sixty-four stops, and 5,000 pipes, the largest of which is fifteen inches in diameter. Among the monuments in the church are those of Bilderdijk the poet and the hydraulic engineers Christiaan Brunings and Fredrik William Conrad, the latter the projector of the sluices at Katwijk. At the head of the scientific institutions of Haarlem may be placed the Dutch society of sciences, founded in 1752, which possesses very valuable collections in botany, natural history and geology.

The staple industries of Haarlem have been greatly modified in the course of time. Under the counts of Holland cloth-weaving and brewing were in a very thriving condition; but under Charles V. they lost enormously in importance. After the revocation of the edict of Nantes, silk, lace and damask-weaving were introduced by French refugees, and in course of time these industries gave employment to 10,000 of the population. About the close of the eighteenth century this remarkable prosperity was a thing of the past; and it was not till after the Belgian revolution that Haarlem began to turn its attention to the various departments of manufacture in which it is now engaged. Cotton factories, carriage-works, bleach-works, cotton and silk dye-works, a famous type-foundry, oil-works, soap-works, breweries, and a factory for preserved meats are among the more important establishments. One of the printing establishments has the reputation of being the oldest in the Netherlands, and publishes the oldest Dutch paper, *De Oprechte Haarlemmer Courant*. As market gardening, especially in the flower department, is largely carried on in the immediate vicinity, Haarlem is the seat of a flourishing trade in "Dutch roots," especially in hyacinths, tulips, fritillaries, spiræas and japonicas. A considerable business is also done in the butter, cheese and other agricultural produce from the surrounding country.

Though the population of Haarlem has been steadily increasing since the beginning of the present century, it has not become so great as it was in the seventeenth. It is now (1890) 40,000.

Haarlem is mentioned in a register of the tenth century as Haralem. From Count William II. it obtained a charter in 1245, and in the course of the following centuries it rapidly advanced in prosperity. In 1492, the insurgents, called the "bread and cheese folk," got possession of the town, but before the year was out it was recovered by the imperial general Duke Albert of Saxony. The year 1493 was witness of a great conflagration, and in 1509 the plague claimed its many victims. In 1559 Haarlem became a bishop's see. The prominent part that its inhabitants took in the revolt of the Netherlands brought upon it an unparelled disaster. Don Frederick, son of the duke of Alva, invested the town with 30,000 men in December, 1572, and after a siege, in which the burghers defended themselves with admirable and pertinacious heroism, it was obliged to capitulate in July, 1573. The conquerors, in spite of their promise of mercy, took barbarous vengeance, and it was not till July, 1677, that the town was recovered from their grasp by the prince of Orange. In its subsequent history the main events are the inundations of 1775 and 1791, the arrival of the Prussians in 1787, and the quartocentenary celebration of the invention of printing in 1823.

HAARLEM LAKE, or HARLEMMER MEER, a commune of the province of North Holland, constituted by the law of July 16, 1855. It has an area of about 46,000 acres, and its population has increased from 7,000, in 1860, to 13,602 in 1878. As its name indicates, the commune was formerly a lake, and, according to Amersfoordt, this lake was a relic of a northern arm of the Rhine, which passed through the district in the time of the Romans. As early as 1643 Jan Adriaanszoon Leeghwater proposed to endyke and drain the lake; and similar schemes, among which those of Nikolaas Samuel Cruquius in 1742, and of Baron van Lijnden van Hemmen in 1821, are worthy of special mention, were brought forward from time to time. But it was not till 1836, when one furious hurricane, on November 9th, drove the waters as far as the gates of Amsterdam, and another on December 25th sent them in the opposite direction to submerge the streets of Leyden, that the mind of the nation was turned seriously to the matter. The first business was to dig a canal round the lake for the reception of the water and the accommodation of the great traffic which had previously been carried on. The canal was made 38 miles in length, with a depth of 9 feet, and a width of 130 feet on the west side of the lake and 115 on the east side. The preliminary works were not completed till 1845. The area inclosed by the canal was rather more than 70 square miles; the average depth of the lake was 13 feet 1.44 inches; and, as the water had no natural outfall, it was calculated that probably 1,000 million tons would have to be raised by mechanical means. Pumping commenced in 1848, and the lake was dry by July 1, 1852. At the first sale of the highest lands along the banks on August 16, 1853, 784 hectares were bought for 575,000 florins, or 733 florins per hectare, but the average price afterward was less. The whole area of 42,000 acres recovered from the waters has brought in 9,400,000 florins, or about £780,000, so that the actual cost to the nation has been 4,400,000 florins, or £300,000, though the expense of the enterprise amounted to 13,787,377 florins, or £1,080,000.

HABAKKUK, one of the minor prophets of the Old Testament, the eighth in order in the Massoretic text. The name of the prophet is peculiar to him, and occurs only in his own writing (i. l; iii. l). As to its meaning

there is some uncertainty, but it is probably a formation from a verb signifying *to entwine, to embrace*.

This book, which it is generally agreed was written by the prophet himself, forms one of the finest remains of ancient Hebrew literature. In conception and style it is not inferior to any production of the most flourishing age of prophecy. The language is pure, the thought is lofty, and in the construction artistic skill is displayed. With the mantle of the prophet the author bears also the chaplet of the poet.

HABEAS CORPUS, in English law, is a writ issuing out of one of the superior courts, commanding the body of a prisoner to be brought before the court. There are various forms of this writ, according to the purposes for which it is intended. Thus *habeas corpus ad respondendum* is to bring up a prisoner confined by the process of an inferior court in order to charge him with a fresh action in the court above. Other forms are *ad satisfaciendum* (when judgment has been had against a prisoner in the court below), *ad faciendum et recipiendum*, or *cum causa* (to remove the proceedings into the superior court, the defendant being under arrest), *ad testificandum* (when the prisoner is wanted as a witness), etc. These forms are now of little or no importance. The most famous form of the writ is the *habeas corpus ad subjiciendum* — the well-known remedy for the violation of personal liberty. It is addressed to the person in whose custody another is detained, and commands him to bring his prisoner before the court, with a statement of the day and cause of his capture and detention — "*ad faciendum, subjiciendum, et recipiendum*, to do, submit to, and receive whatsoever the judge or courts awarding the writ may consider on that behalf."

In the United States the law of *habeas corpus* has been inherited from England, and has been generally made to apply to commitments and detentions of all kinds. Difficult questions, unknown to English law, have arisen from the peculiar features of the American State system. Thus the constitution provides that "the privilege of the writ of *habeas corpus* shall not be suspended unless when, in cases of rebellion or invasions, the public safety may require it;" and it has been the subject of much dispute whether the power of suspension under this provision is vested in the president or in congress. The weight of opinion seems to lean to the latter alternative. Again, conflicts have arisen between the courts of individual States and the courts of the Union. It seems that a State court has no right to issue a *habeas corpus* for the discharge of a person held under the authority of the Federal Government. On the other hand the courts of the Union issue the writ only in those cases in which the power is expressly conferred on them by the constitution.

HABINGTON, WILLIAM, one of the most pleasing of English minor poets, was born at Hendlip in Worcestershire, November 4, 1605. In 1634 he first published his famous volume of lyrical poems entitled *Castara*, which was reprinted in 1635 and 1640. In the latter year he also published a prose *History of King Edward IV.* and *The Queen of Aragon*, a tragi-comedy. The last work printed by Habington was *Observations Upon History*, 1641. In 1647 his father died; and during the Commonwealth, as we learn from Anthony Wood, the poet "did run with the times, and was not unknown to Oliver the usurper." He died November 30, 1654, and was buried in the family vault at Hendlip.

HACHETTE, JEAN NICHOLAS PIERRE, an eminent French mathematician, was born at Mézières, May 6, 1769. For his early education he proceeded first to the college of Charleville, and afterward to that of

Rheims. In 1788 he returned to Mézières, where he was attached to the school of engineering as draughtsman to the professors of physics and chemistry. When twenty-three years of age he succeeded from among a number of candidates in gaining the professorship of hydrography at Collioure and Port-Vendre. While there he sent several able papers, in which some questions of navigation were treated geometrically, to Monge, at that time minister of marine, through whose influence he obtained an appointment in Paris. Thence he passed to a deputy-professorship at Mézières, and toward the close of 1794, when the École Polytechnique was established, he was chosen one of its staff. Earlier in the year, he was present at the battle of Fleurus, and entered Brussels with the French army. In 1816, on the accession of Louis XVIII., he was expelled from his chair by Government, at the same time that his friend and fellow-worker Monge was removed from the Institute. He retained, however, till his death the office of professor in the faculty of sciences in the École Normale, to which he had been appointed in 1810—the same year in which he married the daughter of the physician Maugras. The necessary royal assent was in 1823 refused to the election of Hachette to the Academy of Sciences, and it was not till 1831, after the Revolution, that he obtained that well-merited honor. He died at Paris, January 16, 1834.

HACHETTE, LOUIS CHRISTOPHE FRANÇOIS, a French publisher, was born at Rethel in the Ardennes, May 5, 1800. He devoted several years to the study of jurisprudence, but in 1826 resolved to establish in Paris a publishing business, the main object of which should be the issue of works adapted to improve the system of school instruction, or to promote the general culture of the community. The series of works which from that time were brought out by him included manuals in various departments of knowledge, dictionaries of modern and ancient languages, educational journals, and French, Latin, and Greek classics annotated with great care by the most eminent authorities. Subsequent to 1850 he, in conjunction with other partners, published a cheap railway library, scientific and miscellaneous libraries, an illustrated library for the young, libraries of ancient literature, of modern foreign literature, and of modern foreign romance, a series of guide-books, and a series of dictionaries of universal reference. In 1855 he also founded *Le Journal pour tous*, a publication with a circulation of 150,000 weekly. He died July 31, 1864.

HACKBERRY, a name given to the fruit of the *Celtis occidentalis*, L., belonging to the natural order *Ulmaceæ*. It is also known under the name of "sugar berry," "beaverwood," and "nettle tree." The hackberry tree is of middle size, attaining from sixty to eighty feet in height, and with the aspect of an elm. The leaves are ovate, cordate-ovate, and ovate-lanceolate, with a very long taper point,—mostly glabrous above, and usually soft-pubescent beneath. The soft filmy flowers appear early in the spring before the expansion of the leaves. The fruit or berry, about the size of a bird-cherry, is of an obovate shape, of a reddish or yellowish color when young, turning to a dark purple in autumn. This tree, together with other species of the same genus, is distributed through the deep shady forests bordering the river banks of New England to Wisconsin and even further southward.

HACKENSACK, the capital of Bergen county, N. J., is a thriving manufacturing town of 6,000 inhabitants, situated on the Hackensack river, twelve miles north of New York city, and eight southeast of Paterson, N. J.

HACO, or HAKON (c. 920–90), surnamed the Good, king of Norway, was the son of Harold Fairhair by a

female slave, and was presented by Harold to King Athelstan of England, to mark his contempt for an insult he had received. The child was placed by a Norse warrior on Athelstan's knee, who was thus made to observe the symbol of adopting a child that was base born. Athelstan did not, however, take vengeance on the innocent cause of his anger, but brought him up as one of his own sons. On hearing of the death of Harold, he supplied Haco with men and ships, and sent him to Norway to wrest the throne from Eric, eldest son of Harold, whose violent and cruel reign had during the life of his father gained him the general hatred of his subjects. The news of Haco's arrival in Norway spread, says the saga, "like fire through dried grass." Eric at once took flight to Orkney and then to England, and Haco was chosen king at every "thing." Haco, though himself a Christian, found it impossible in his time to establish Christianity in Norway. He ruled his kingdom with great justice and prudence, and gained for it many victories over the Danes by land and sea. He was slain in a great fight against the Danes, led by the sons of Eric, about the year 960.

HACO, V., surnamed the Old, king of Norway, son of Haco IV., was, on the death of his father, in 1204, excluded from the throne on the ground of supposed illegitimacy, and only became king in 1223, after his mother, to establish his rights, had undergone the ordeal of fire. He greatly increased the prosperity of Norway, and he also added to his kingdom Iceland and Greenland. He died in 1264.

HADAD, the name of a Syrian deity, is met with in Scripture as the name of several human persons; it also occurs in the compound Benhadad, Hadadrimmon; and Hadadezer. The etymology of the word, of which Hadar, Ader and Arad appear to be incorrect variations, is obscure; the divinity primarily denoted by it, however, according to Philo of Byblos, is the king of the gods, the greatest and highest, the sun; and these interpretations seem to point to some such radical meaning as *unicus*.

HADDINGTON, or EAST LOTHIAN, a maritime county in Scotland. It is bounded on the north by the Firth of Forth, on the east by the North sea, on the south by Berwickshire, on the west by Edinburghshire. Its seaboard is thirty-two miles. Its greatest length from east to west is twenty-five miles, its breadth from north to south about sixteen miles. Population (1890), 42,000.

HADDINGTON, a royal and parliamentary burgh, and the chief town of the above county, is situated on the banks of the Tyne, about seventeen miles east of Edinburgh. It occupies almost the center of the shire to which it has given the name. John Knox was born here in 1505.

HADDOCK, a kind of cod-fish, distinguished by a black lateral line and a blackish spot above the pectoral fin. It is common round the British and Irish coasts, and generally distributed along the shores of the North Sea, extending across the Atlantic to the coast of North America. The haddock is prone, however, to abandon for a longer or shorter period a locality frequented by it. It attains to a weight of fifteen pounds, and is one of the most valuable food fishes.

HADERSLEBEN, a town of Prussia, capital of a circle in the province of Schleswig-Holstein, is situated forty-eight miles north of the town of that name, in a pleasant valley on the Hadersleben fiord, which is about nine miles in length and communicates with the Little Belt. The population, including the garrison, is 8,356.

HADES, a word used by Homer for the god of the under-world, and by later writers for the under-world

itself. It corresponds with the Hebrew word Sheol. In the New Testament, particularly in the Revelation, it is the equivalent of Hell, but in Psalm vi. 5, the righteous are represented as going to Sheol, rendered "the grave" in the authorized version. (See PLUTO and ESCHATOLOGY.)

HADJI KHALFA. See HAJJI KHALFA.

HADRAMAUT. See ARABIA.

HADRIAN, Roman emperor, distinguished for the peace and beneficent energy of his government, was born at Rome 76 A.D. His full name was Publius Ælius Hadrianus; his ancestors, originally from Picenum, had been settled at Italica in Spain since the time of the Scipios. He lost his father at the age of ten, and was placed under the guardianship of Trajan, a cousin of his father and also a native of Italica, who was already a conspicuous man in the Roman army. We know little of Hadrian's youth, but he gave early promise of the readiness and versatility which distinguished him in later life, for he was so ardent a student of Greek that men nicknamed him Græculus. Patronized by Trajan and assisted by powerful friends, he rose rapidly, filling successively all the civil and military offices, which were open to young men of good birth. On Trajan's elevation to the empire Hadrian was the first to congratulate him. He served with distinction in both the Dacian campaigns; in the latter Trajan presented him with the ring he had received from Nerva, a proof of his regard which justified him in aspiring to be his successor. When Trajan returned from his victorious war in Parthia, the succession was still undecided; and we are assured on the express testimony of Dion Cassius that the Empress Plotina and her friends concealed his death for several days in order to facilitate the elevation of Hadrian. Whatever may have been the truth of such stories, Hadrian's claim to the empire rested on the unquestionable fact that he was the fittest man. His position as prefect of Syria, and commander of the legions with which Trajan had prostrated the Parthian empire, made him supreme in the army, while his peaceful disposition and civil demeanor must have made him acceptable to the senate. Yet he was not unconscious of the insecurity of his position; for he hastened to propitiate the army by a donation of twice the usual amount, and to excuse his abrupt elevation to the senate by alleging the impatient zeal of the soldiers and the welfare of the state, which could not exist without an "imperator." The first important act of Hadrian was to abandon the late conquests of Trajan, and again to make the Euphrates the eastern boundary of the empire. While arranging the affairs of the East, Hadrian had an opportunity of pardoning some eminent citizens who were accused of hostility toward him, and after his return to Rome he confirmed his popularity by many gracious acts. Modestly declining the honors heaped upon himself, he carefully rendered the last offices to the deceased emperor, and considerably lightened the burdens of the citizens. During an absence in Mœsia, where he had gone to compose some troubles with the Sarmatæ and Roxolani, a formidable conspiracy was formed against him. The details are obscure; but four consular men, among the most eminent of Rome, were accused of being concerned in it, and were put to death. Some, however, went so far as to say that the conspiracy was a scheme devised by Hadrian for getting rid of dreaded rivals. It was a dark transaction which threw a suspicion on his character. On his return to Rome he exerted himself to undo the evil effects of it by a generous and popular policy. He was liberal to the body of the people, granting them a large donation of money, remitting the arrears of taxes for the last fifteen years, and increasing the funds which Trajan had devoted to the alimentation

of poor children. He saw that the period of conquest was past, that an extension of the frontiers would only weaken the defensive power of the empire, that the time for consolidation and for softening the distinction between Rome and the provinces was come. Leaving Rome in 119, he visited probably every province of the empire. After traversing Gaul he inspected the legions on the Rhine, and then crossed to Britain, where he built (121) the great rampart from the Tyne to the Solway which bears his name. He returned through Gaul into Spain, and then proceeded to Mauritania, where he suppressed an insurrection. We next find him in the East averting a war with Parthia by a timely interview with the king. From the Parthian frontier he traveled through Asia Minor and the islands to Athens, where he sojourned a considerable time, and so returned by Sicily to Rome, having made the circuit of the empire. After some stay at Rome he resumed his travels. It is impossible to fix the details of this second progress with any exactness. It was chiefly in the East; and he did not finally return to Rome till 134. Everywhere he left lasting traces of his restless and beneficent energy; he built aqueducts and temples, and raised fortifications in suitable places; he inspected the details of the administration, learned to know the officials, and made himself at home in the military encampments. Athens was the favored scene of his architectural labors; he added a new quarter to the city, and finished the temple of the Olympian Zeus. While Hadrian spent his life in inspecting the provinces, and was not disinclined to purchase peace by a subsidy to the restless tribes of the frontiers, he did not neglect the army. All along the frontier his legions stood in constant preparation for battle. He maintained a rigorous discipline; the rules he drew up for the army long served as a kind of military code. The only important war in which this army was tested was the great rebellion of the Jews, which broke out in 131, and lasted for several years. The founding of a Roman colony on the site of Jerusalem, and an order of Hadrian forbidding the rite of circumcision, were the causes of the war. The Jews fought with the most resolute despair, and they were crushed only by a powerful army commanded by the best general of the empire. According to Dion, 580,000 Jews fell in battle. He built for his residence the great villa of Tibur, which was eight miles in circuit, and was a kind of epitome of the world, with miniatures of the most celebrated places in the provinces, and even of Hades. He built a splendid mausoleum, which became the nucleus of the castle of St. Angelo, and rebuilt several edifices at Rome. In these years he had to choose a successor. His first choice was Ælius Verus, who did nothing to justify such a distinction. The next was Antoninus Pius, so called from the filial assiduity with which he cherished the last days and the memory of his adopted father. Antoninus saved him from suicide, to which his physical sufferings impelled him, and from imbruing his hands in the blood of many noble Romans, who had provoked his moody and fickle temper. Hadrian died at Baiæ, 138 A.D.

HADRIAN, WALL OF. Under this heading it seems most convenient to give a short account of the stone wall and other works erected by the Romans in the north of England between the Solway and Tyne, and commonly known as the Roman Wall.

Viewed as a whole the Roman Wall, when entire, consisted of three parts: (1) a stone wall, strengthened by a ditch or fosse, at a short distance from its northern base; (2) three parallel earthen walls, with a ditch sloping down from the northern side of the second of these lines; (3) stations, castles and turrets, placed at various intervals for the accommodation of troops, and communicating with one another by a military way. The

Murus or stone wall extended from Wallsend on the Tyne to Bowness on the Solway Firth, a distance of fully 73 English miles. No portion of it now remains as when finished, so that its original height cannot be accurately determined. Bede gives twelve feet, an estimate that our chief modern authority on the wall, Dr. J. Collingwood Bruce, deems too low, for some parts of its course at least. Its thickness varies, being six feet in some places and nine and a half in others.

The northern face of the wall was continuous, but the southern had numerous outsets and insets, as if portions of the work had been carried on at the same time but without definite instructions as to a uniform breadth. Both sides consisted of blocks of freestone eight or nine inches thick, ten or eleven broad, and from fifteen to twenty long. These had been sometimes quarried near the spot, sometimes brought from considerable distances. Along the whole length of its northern base, and adding greatly to its strength as a defensive work, was drawn a ditch or fosse of varying breadth and depth, thirty-six and fifteen feet respectively being probably its average dimensions. In some places the difficulties to be overcome by its excavators, owing to the rocky nature of the soil, must have been enormous in an age when blasting with gunpowder was unknown. But none of them have been shunned.

Several of the ancient writers allude to ramparts and lines of forts raised by the Romans across the island during the time they had a footing in it. Of these notices some refer to the barrier on the isthmus of the Forth and Clyde; the others probably apply to the more important works now described.

HADRUMETUM, or ADRUMETUM (the name appears in the Greek writers in a great variety of forms), a city on the African coast of the Mediterranean on the Sinus Neapolitanus or Gulf of Hamamet.

HÆMORRHOIDS (from αἷμα, blood, and ῥέω, to flow), commonly called piles, a frequent and distressing malady. Two varieties are described. The external pile is an overgrowth of the thin dark-colored skin round the opening; there is most frequently more than one present; the skin, lax and redundant, hangs in folds. The internal pile lies altogether within the opening, although it may appear externally protruding through the anus when any pressure from above is applied, as when the patient strains at stool. There may be several internal piles. The internal pile is sessile or pedunculated. The external pile is of a pale color. The internal pile is moist, vascular and of a cherry-red color; is apt to inflame, and the inflammation is associated with heat, pain, and general uneasiness. Ulceration and bleeding are common symptoms of the internal pile, hence the term "bleeding" or "bloody piles." Any cause which, by pressing on the large abdominal veins, retards the upward flow of blood to the heart, will give rise to piles; such are constipation, diseases of the liver, pregnancy. The exciting cause is frequently exposure to damp, as from sitting on the wet ground. The local treatment is palliative or radical. The palliative treatment consists in attention to the state of the bowels, cold bathing, astringent (tannic acid, nutgalls, hydrastis, etc.) injections, lotions, and ointments. The radical treatment consists in their removal (which should be attempted only by a thorough surgeon). Radical treatment should not be undertaken until palliative treatment has failed. When in a state of inflammation the treatment consists in hip baths, hot fomentations, and poultices. The introduction of a morphia suppository often relieves the uneasiness. Both varieties are often met with in the same individual. The internal piles are apt to return if the predisposing cause is still in existence, and for this reason the stool should be carefully

watched and the return of costiveness prevented. There is a form of pile situated just at the verge of the anus, where the skin joins the mucous membrane: its onset is sudden, and due to the rupture of a blood-vessel; the blood is extravasated and clots; a small, tense, painful swelling of a bluish color is seen at the edge of the anus. This may be relieved by hot fomentations, or the pile may be laid open and the clot turned out by gentle pressure.

HAFIZ. Muhammed Shamsuddin, better known by his *nom de plume* of Háfiz, was one of the most celebrated writers of Persian lyrical poetry. He was born at Shiraz, the capital of Fars, in the early part of the eighth century of the Mahometan era, that is to say, in the fourteenth of our own. The exact date of his birth is uncertain, but he is known to have attained a ripe old age, and to have died in 791 A.H. (1388 A.D.) Very little is actually known about his life, which appears to have been passed in quiet retirement and literary ease in his native city of Shiraz, of which he always speaks in terms of affectionate admiration. He was a subject of the Muzaffar princes, who ruled in Shiraz, Yazd, Kirman and Ispahan, until the dynasty was overthrown by Timur-lang (Tamerlane). Of these princes his especial patrons were Shah Shujá and Shah Mansúr. The restraints of an ascetic life seem to have been very little to Háfiz's taste, and his loose conduct and wine-bibbing propensities drew upon him the severe censure of his monastic colleagues. In revenge he satirizes them unmercifully in his verses, and seldom loses an opportunity of alluding to their hypocrisy and religious pretensions. Háfiz's fame as a poet was soon rapidly spread throughout the Mahometan world, and several powerful monarchs sent him presents and pressing invitations to visit them. Among others he was invited by Mahmúd Shah Bahmani, who reigned in the south of India, and set off with the intention of sojourning at the court of that sovereign. After crossing the Indus, and passing through Lahore he reached Hurmuz, and embarked on board a vessel sent for him by the Indian prince. He seems, however, to have been a bad sailor, and, having invented an excuse for being put ashore, made the best of his way back to Shiraz. He was, like most Persians, a Shiah by religion, believing in the transmission of the office Imám, or head of the Muslim church in the family of Ali, cousin of the prophet, and rejecting the *Hadith*, or traditional sayings of Mahomet, which form the Sunneh or supplementary code of Mahometan ceremonial law.

His principal work is the *Díván*, that is, a collection of short odes or sonnets called *ghazals*, and consisting of from five to sixteen *baits* or couplets each, all the couplets in each ode having the same rhyme in the last hemistich, and the last couplet always introducing the poet's own *nom de plume*. The whole of these are arranged in alphabetical order, an arrangement which certainly facilitates reference, but makes it absolutely impossible to ascertain their chronological order, and therefore deteriorates from their value as a means of throwing light upon the growth and development of his genius or the incidents of his career. These "orient pearls at random strung," as a version of a passage from Háfiz, in Sir William Jones' grammar, calls them, are often held together by a very slender thread of continuous thought, and very few editions agree exactly in the order of the couplets which form the individual *ghazals*.

HAGEDORN, FRIEDRICH VON, one of the most distinguished German poets in the earlier half of last century, was born April 23, 1708, at Hamburg, where his father was Danish minister at the court of Lower Saxony. The father, a man of scientific and literary tastes, possessed a valuable library of French literature.

and dabbled also in alchemy. Having, by this and other means, lost a great part of his fortune, he died in 1722, leaving in poor circumstances a widow and two sons, of whom the poet was the elder. The boy was educated at the gymnasium of Hamburg, and went later (1726) to study jurisprudence at Jena. Shortly after his return to Hamburg, in 1729, he obtained the appointment of private secretary, without salary, to the Danish ambassador in London, where he lived till 1731, and published two small works in English. In 1733 Hagedorn became secretary to the so-called "English court" in Hamburg, a trading company founded in the thirteenth century, and formerly known as "Die Societät der Aventurier Kaufleute." He shortly afterward married, and, from this time, with a settled income and sufficient leisure to pursue his literary occupations, led a pleasant and congenial existence, surrounded by friends and admirers, till his death, at the early age of forty-seven, October 28, 1755.

HAGEN, a town of Prussia, at the head of a circle in the Arnsberg government of Westphalia, is situated at the confluence of the Empe with the Volme, and at the junction of several railways, twenty-six miles west-southwest from Arnsberg. It is the seat of a provincial office, a circle court, a chamber of commerce, a state railway commission, and an agricultural union. Population (1890), 28,000.

HAGEN, FRIEDRICH HEINRICH VON DER, distinguished for his researches in Old German literature, was born at Schmiedeberg in Brandenburg, February 19, 1780. In 1810 he was appointed professor extraordinarius of German language and literature in the university of Berlin, in the following year was transferred to a similar professorship in Breslau, and in 1821 returned to Berlin as professor ordinarius. He died at Berlin, June 11, 1856.

HAGENAU, the chief town of a circle and canton in Alsace-Lorraine, Germany, district of Lower Alsace, is situated in the middle of the Hagenau forest, on the Moder, and on the railway from Strasburg to Weissenburg. Population (1890), 12,000.

HAGENBACK, KARL RUDOLF, distinguished as a church historian, was born March 4, 1801, at Basel. His preliminary education was received at a Pestalozzian school, and afterward at the gymnasium, whence in due course he passed to the newly reorganized local university. The years 1820-1823 were spent first at Bonn, where Lücke exerted a powerful influence on the formation of his opinions, and afterward at Berlin, where Schleiermacher, and still more Neander, became permanently his masters. Returning in 1823 to Basel, he became professor extraordinarius, and in 1829 professor ordinarius of theology. Apart from his special academic labors during many years in connection with the history of dogma and the church (which first owed to him their recognition as distinct branches of study at Basel), he lived a life of great and varied usefulness as a theologian, a preacher, and a citizen; and at his "jubilee" in 1873, not only the university and town of Basel, but also the various churches of Switzerland, united to do him honor. He died at Basel, June 7, 1874.

HAGERSTOWN, a Maryland city, the county seat of Washington county, is situated on Antietam creek, eighty-five miles from Baltimore. It is of some importance as a railway center, and has good banking and telegraph facilities. Its manufactures are considerable, comprising machinery, leather, flour and bricks. It contains several educational institutions and an ample quota of churches. Population (1890), 10,000.

HAG-FISH, GLUTINOUS HAG, or BOREZ (*Myxine*), a marine fish, which forms with the lampreys, one of

the lowest orders of vertebrates (*Cyclostomata*). It is occasionally found in the North Atlantic.

HAGGAI, the tenth in order of the minor prophets. The book of Haggai contains four short prophecies, delivered between the first day of the sixth month and the twenty-fourth day of the ninth month—that is, between September and December—of the second year of Darius the king. The king in question must be Darius Hystaspis, who came to the throne 521 B.C. The language of the prophet suggests the probability that he was himself one of those whose memories reached across the seventy years of the captivity, and that his prophetic work began in extreme old age. This supposition agrees well with the shortness of the period covered by his book, and with the fact that Zechariah, who began to prophesy in the same autumn, and was associated with Haggai's labors (Ezra v. 1), afterward appears as the leading prophet in Jerusalem (Zechariah vii. 1-4). We know nothing further of the personal history of Haggai from the Bible.

HAGUE, THE, a town of the Netherlands, in the province of South Holland, thirteen miles northwest of Rotterdam, ten miles southwest of Leyden, and two miles inland from the German ocean. It is connected with both Rotterdam and Leyden by the "Holland Railway," and with Utrecht by the railway of the Rhine. Besides being the chief town of the province, the Hague is the usual residence of the court, and the seat of the government, the states-general, the high council of the Netherlands, the council of state, the chamber of accounts, and various other administrative bodies. The characteristics of the town are quite in keeping with its political position. It is the handsomest, the most fashionable, and the most modern looking town in the Netherlands. D'Amicis rightly describes it in his *Olanda* as half Dutch half French. The center of the Hague, both historically and topographically, is the buildings of the court. The oldest portion was founded by Count William II., "king of the Romans," in 1249. A handsome Gothic building, with towers at each corner of the façade, contains the great or knights' hall, a noble chamber 130 feet in length, sixty-two feet in breadth, and sixty-nine in height, in which the states of the Netherlands abjured their allegiance to Philip II. of Spain, and in front of which the gray-headed Olden-Barneveldt lost his life in 1619. To the southeast of the hall is the troonzaal, or throne room, in which the second chamber of the states-general holds its sittings; and to the west is the meeting place of the first chamber. The royal palace proper was purchased by the states of the Netherlands in 1595, rebuilt by Prince William III., and extended by King William I. The palace of the prince of Orange was founded about 1720 by Count Unico William of Wassenaar Twiekels; the Palace of Prince Frederick of the Netherlands dates from 1825 to 1828; the palace of Prince Henry was erected in 1743 for the deputies of Rotterdam; and the palace of Prince Alexander was in the seventeenth century the house of John de Witt, pensionary of the council. Among the public institutions of the Hague the following are the most important: The royal library, with upward of 100,000 volumes, the Museum Meermanno-Westreenianum, the royal picture gallery in the Prins-Mauritz-Huis, the Vijverberg hôtel, with a collection of curiosities; the town museum of antiquities and modern art; the zoölogical gardens, founded in 1862; the royal school of design and music; and the new buildings for the arts and sciences, erected in 1874.

The principal industries of the town are iron-casting, copper and lead smelting, cannon-founding, the manufacture of furniture and carriages, silk-dyeing, liqueur-

distilling, lithographing, and printing. The population (1890) is about 130,000.

The Hague, mentioned as early as 1097 in a document by Count Floris II., seems originally to have been a shooting lodge of the counts of Holland. Under William II. it became a residence of the court; and in the fifteenth century it begins to be called a town, though for long after, down even to the time of Louis Napoleon, it was as frequently described as a village. In 1479 the soldiers of Maximilian of Austria put the place to ransom; in 1525 it was the scene of the martyrdom of Johannes Pistorius (Jan de Bakker of Woerd); in 1528 it was plundered by the people of Guelderland; and in 1572, 1573 and 1574 it was laid waste by the Spaniards. Restored by William I. in 1576, it was in 1584 the seat of the sessions of the States of Holland. In 1672 it was the scene of the famous assassination of the brothers De Witt. It was at the Hague that the convention was arranged in 1710, between the German emperor, the king of Prussia, the emperor of Russia, and the maritime powers, for the maintenance of the neutrality of North Germany; it was at the Hague that the Triple Alliance of 1717 was concluded, and that the peace of the same year was signed between Spain, Savoy and Austria. From 1782 to 1787 the town had its full share in the civil disturbances of the country. In 1808 it was made the seat of the Government administrative offices.

HAHN, AUGUST, German Protestant theologian, was born March 27, 1782, near Eisleben, Saxony, and entered the university of Leipsic as a student of theology in 1810. After holding an educational appointment in Wittenberg for some time, in 1819 he was nominated professor extraordinarius of theology at Königsberg, and in the following year received a pastoral charge and a superintendency in that city. These posts, however, he soon resigned on his promotion in 1821 to be professor ordinarius. In 1826 he removed as professor of theology to Leipsic. In 1833 Hahn was called to Breslau as theological professor and consistorial councilor, and in 1844 he became general superintendent of the province of Silesia. He died at Breslau, on May 13, 1863.

HAHN, JOHANN GEORG VON, an Austrian traveler, to whom we are indebted for most of our knowledge about the Albanians, was born at Jena in 1810, and died in 1869.

HAHNEMANN, SAMUEL CHRISTIAN FRIEDRICH (1755-1843), the founder of the homœopathic system of medicine, was born at Meissen, in Saxony, April 10, 1755. He studied first at the Elector's school of Meissen, and afterward as a student of medicine at Leipsic and Vienna. He took the degree of M.D. at Erlangen in 1779, and after acting as physician at various places returned in 1789 to Leipsic, where he largely occupied himself in the translation of medical works. While working at Cullen's *Materia Medica*, he was struck by the contradictory accounts given of the properties of Peruvian bark. He had previously meditated much on the unsatisfactory nature of the science of medicine; and, after much reflection and many experiments, he became convinced of the truth of the principle *similia similibus curantur* (see HOMŒOPATHY), i.e., the cure for a disease is the very drug that would in a healthy person produce the symptoms of such disease. Further experiments convinced him that the conventional doses produced symptoms of unnecessary and dangerous violence, and this led to another principle, that of minimum doses, according to which the benefit to be derived from a medicine can be fully obtained by the administration of a very small quantity. Firmly convinced of the truth of these principles, Hahnemann spent the rest of his life

in making them known to the world. He encountered much opposition, and in 1821 was forced to leave Leipsic, as he was not allowed to dispense his own prescriptions. The grand duke of Anhalt-Köthen, however, appointed him his physician, and at Köthen he resided till 1835, when he removed to Paris. He died July 2, 1843. Hahnemann was a man of remarkable courage and perseverance. He not only sacrificed his immediate interests for the sake of his convictions, but made many painful experiments upon his own person.

HAIDARÁBÁD. See HYDERABAD.

HAIDINGER WILHELM VON, a mineralogist, geologist and physicist of considerable note, was born at Vienna, February 6, 1795. In 1822 Haidinger visited France and England with Count Breunner, and, journeying northward, took up his abode in Edinburgh. He translated into English, with additions of his own, Mohs' *Grundriss der Mineralogie*, published at Edinburgh in three volumes under the title, *Treatise on Mineralogy*, 1825. After a tour in Northern Europe, including the Scandinavian mining districts, he undertook the scientific direction of the porcelain works at Elbogen, belonging to his brothers: In 1840 he was appointed counselor of mines (Bergrath) at Vienna in the place of Professor Mohs, a post which includes the charge of the imperial cabinet of minerals, etc. He devoted himself to the reërrangement and enrichment of the collections, and the cabinet became the first in Europe. Shortly after (1843) Haidinger commenced a series of lectures on mineralogy. On the establishment of the imperial geological institution, he was chosen director (1849); and this important position he occupied for seventeen years. On the completion of the geological survey of the Austrian dominions, in 1862, he superintended the preparation of the maps which were issued. He was elected a member of the imperial board of agriculture and mines, and a member of the imperial academy of sciences of Vienna. He organized the society of the friends of natural sciences. As a physicist Haidinger ranked high, and he was one of the most active promoters of scientific progress in Austria. He was the discoverer of the interesting optical appearances which have been called after him "Haidinger's brushes." Knighted in 1865, the following year he retired to his estate at Dornbach, near Vienna, where he died March 19, 1871.

HAIL. See METEOROLOGY.

HAILES, SIR DAVID DALRYMPLE, BART., LORD, an eminent Scottish lawyer and historian, was born at Edinburgh, October 28, 1726. As a pleader, he attained neither high distinction nor very extensive practice, but he rapidly established a well-deserved reputation for sound knowledge, unwearied application, and strict probity; and in 1766 he was elevated to the bench, when he assumed the title of Lord Hailes. Ten years later he was appointed a lord of justiciary. His death took place on November 29, 1792.

HAINAN, or, as it is usually called in Chinese, *Kiung-chow-foo*, an island belonging to the Chinese province of Kwang-tung, and situated between the Chinese Sea and the Gulf of Tong-king. It measures 160 miles from northeast to southwest, and the average breadth is about ninety miles. The area is estimated from 1,200 to 1,400 square miles, or two-thirds the size of Sicily. From the peninsula of Lei-chow on the north it is separated by the straits of Hainan, which have a breadth of fifteen or twenty miles.

With the exception of a considerable area in the north, and broad tracts on the northeast and northwest sides, the whole island is occupied by jungle-covered mountains, with rich valleys between. Snow falls so rarely that its appearance in 1684 is reported in the native

chronicles as a remarkable event. Earthquakes are a much more familiar phenomenon. Excellent timber of various kinds—eagle-wood, rose-wood, liquidambar, etc.—is one of the principal products of the island, and has been transported to Peking for imperial purposes. The cocoa palm flourishes freely even in the north, and is to be found growing in clumps with the *Pinus sinensis*. Rice, cotton, sugar, indigo, cinnamon, betel-nuts, sweet potatoes, ground-nuts, and tobacco are all cultivated in varying quantities. The original inhabitants collect a kind of tea called tein-cha, or celestial tea, which looks like the leaves of a wild camellia, and has an earthy taste when infused. Lead, silver, copper, and iron occur in the Shih-luh-Shan or “stone-green-hill;” the silver at least was worked till 1850, and the copper would probably pay for its exploitation. Gold and lapis lazuli are found in other parts of the island.

Hainan, as already indicated, forms a foo or department of the province of Kwang-tung, though strictly it is only a portion of the island that is under Chinese administration, the remainder being still occupied by unsubjugated aborigines. The capital Kiung-chow-foo is situated in the north about ten li (or three miles) from the coast on the river. It is a well-built compact city, and its temples and examination halls are in good preservation. The population is frequently stated at 200,000, but according to C. C. Stuhlmann in the *Globus* for 1876, it is only 100,000.

The inhabitants of Hainan may be divided into three classes, the Chinese immigrants, the civilized aborigines or Shu-li, and the wild aborigines or Sheng-li. The whole population of the island is estimated at about two and one-half millions. At its first conquest 23,000 families were introduced from the mainland. In 1300 the Chinese authorities assign 166,257 inhabitants; in 1370, 291,000; and in 1617, 250,524; and now, 1,350,000.

HAINAU (officially HAYNAU), a town in the Prussian province of Silesia, circle of Goldberg-Hainau and government district of Liegnitz, is situated on the Rapid Deichsel and on the railway from Breslau to Dresden, twelve miles northwest of Liegnitz. Population, 6,000.

HAINAULT, one of the nine provinces of the kingdom of Belgium, bounded east and north by Namur, Brabant, and Flanders, which are also Belgian provinces, and to the south and west by the French department du Nord. Hainault is well-wooded and hilly in the east and southeast, where it is partly covered by the Ardennes; the rest of the province is a pleasantly diversified, fertile, and well-cultivated plain land, which produces all kinds of cereal crops, flax, tobacco, chicory, and beetroot. The long and narrow coal-field which, with some breaks, stretches from Aix-la-Chapelle to the sea near Boulogne, passes through the middle of Hainault, underlying a district of about 190,000 acres; its center is about Mons, whence it extends westward to Valenciennes, eastward to Charleroi.

HAINBURG, or HAIMBURG, a town of Austria, in the circle of Bruck, situated on the Danube, twenty-seven miles east-southeast of Vienna; is the seat of a district court of justice and of a tax office. It occupies part of the site of the old Celtic town Carnuntum, destroyed 251 A.D. Present population, 5,000.

HAINICHEN, a town of Saxony, in the circle of Leipsic and the prefecture of Döbeln, is situated on the Little Striegis, fifteen miles northeast of Chemnitz.

HAIR is a substance which, from its various properties, and differences in stoutness, length, and strength, enters into a considerable variety of manufactures. Bristles are the stout elastic hairs obtained from the backs of certain breeds of pigs. The finest qualities, and the greatest quantities as well, are obtained from Russia, where a variety of pig is reared principally on

account of its bristles. The best and most costly bristles are used by shoemakers, secondary qualities being employed for toilet and clothes-brushes, while inferior qualities are worked up into the commoner kinds of brushes used by painters and for many mechanical purposes. For artists' use and for decorative painting, brushes or pencils of hair from the sable, camel, badger, polecat, etc., are prepared. The hair of various animals which is too short for spinning into yarn is utilized for the manufacture of felt. For this use the hair of rabbits, hares, beavers, and of several other rodents is largely employed, especially in France, in making the finer qualities of felt hats. Cow hair, obtained from tanneries, is used in the preparation of roofing-felts, and felt for covering boilers and steam-pipes, and for other similar purposes. It is also largely used by plasterers for binding the mortar of the walls and roofs of houses, and of late years it has to some extent been woven up into coarse friezes, horse-cloths, railway rugs, and inferior blankets. The tail hair of oxen is also of value for stuffing cushions and other upholstery work, for which purpose, as well as for making the official wigs of law officers, barristers, etc. The tail and body hair of the yak or Thibet ox is also sometimes imported into Europe. The tail and mane hair of horses is in great demand for various purposes. The long tail hair is especially valuable for weaving into hair-cloth, mane hair and the short tail hair being, on the other hand, principally prepared and curled for stuffing the chairs, sofas, and couches which are covered with the cloth manufactured from the long hair. The horse hair used in Great Britain is principally obtained from South America, Germany, and Russia, and its sorting, cleaning, and working up into the various manufactures dependent on the material are industries of some importance. In addition to the purposes already alluded to, horse hair is woven into crinoline for ladies' bonnets, plaited into fishing lines, woven into bags for oil and cider pressers, and into straining cloths for brewers, etc., and for numerous other minor uses. The manufactures which arise in connection with human hair are more peculiar than important, although occasionally fashions arise which cause a large demand for human hair. The fluctuations of such fashions determine the value of hair; but at all times long tresses are of considerable value. Gray, light, pale, and auburn hair are distinguished as extra colors, and command much higher prices than the common shades. The value of hair also increases very rapidly with increase in length. Thus while eight-inch hair sells at about 1 shilling per ounce, thirty-six-inch hair will command a price as high as 30 shillings per ounce. Lengths beyond thirty-six inches are exceptional and command fancy prices, the standard length in the hair trade being eighteen inches. The light colored hair is chiefly obtained in Germany and Austria, and the south of France is the principal source of the darker shades. In the south of France the cultivation and sale of heads of hair by peasant girls is a common practice, and hawkers attend fairs for the special purpose of engaging in this traffic. Hair five, and even six feet long, is sometimes obtained. Scarcely any of the “raw material” is obtained except in the form of ladies' “combings.” Bleaching of hair by means of peroxide of hydrogen is now extensively practiced, with the view of obtaining a supply of golden locks, or of preparing white hair for mixing to match gray shades; but in neither case is the result very successful. Human hair is worked up into a great variety of wigs, scalps, artificial fronts, frizzets, and curls, all for supplementing the scanty or failing resources of nature. The plaiting of human hair into articles of jewelry, watch-guards, etc., forms a distinct branch of trade.

HAIRBELL. See HAREBELL.

HAIR-TAIL (*Trichiurus lepturus*), a marine fish, with a long band-like body terminating in a thread-like tail, and with strong prominent teeth in both jaws. Several species are known.

HAITI. See HAYTI.

HAJDÚK, sometimes corrupted into HEYDUKE, is the plural form of the Magyar word Hajdú, and was formerly used as the collective name of the undermentioned towns (along with Vámos-Pércs, population, 3,000) of the old privileged Hajdúk district of Hungary, now included in the county of Hajdú.

HAJDÚ BÖSZÖRMÉNY, the second town in importance of Hajdú county, lies about eleven miles to the northwest of Debreczin. Population, 19,208.

HAJDÚ DOROG is a market town situated about ten miles to the north of Böszörmény. Population, 8,200.

HAJDÚ HADHÁZ is a corporate town lying about ten miles north of Debreczin. Population, 7,024.

HAJDÚ NÁNÁS is a market town, about twenty, four miles north-northwest of Debreczin. Population, 13,198.

HAJDÚ-SZOBOSZLO is a corporate town, twelve miles to the southwest of Debreczin. Population, 12,269.

The Hajdúk district was made over to the Hajdúks in 1605, with special privileges and the rights of nobility, by the Transylvanian prince Stephen Bocskay, as a reward for military service rendered him in his revolutionary campaigns. The inhabitants were confirmed in their possessions by the diet of 1613. It now forms the principal portion of the new county of Hajdú, constituted in 1876, and including, along with the old Hajdúk district, portions of the neighboring counties of Szabolcs and Bihar. Debreczin is the capital, and the population is computed at about 163,000, mostly Magyars.

HÁJÍPUR, a municipal town in Muzaffarpur district, Bengal, situated on the east bank of the Gandak, a short distance above its confluence with the Ganges opposite Patná. The population numbers 22,306.

HAJJÍ KHALFA. Mustafa 'bn Abdallah, Kátib Chelepi, commonly known as Haji (or Hadji) Khalfa (more properly Hájji Khalifah), was the author of an encyclopædia in Arabic of Oriental biography and bibliography. He was born at Constantinople about the beginning of the seventeenth century of the Christian era, and died in 1658.

HAKE (*Merluccius vulgaris*), a fish belonging to the family of cod-fishes (*Gadidae*), differing from the common cod in having only two dorsal and one anal fin. It is very common on the coasts of Europe and Eastern North America, but its flesh is much less esteemed than that of the true *Gadi*. Specimens four feet in length are not scarce. A closely allied fish inhabits the coasts of Chili and New Zealand.

HAKIM, or, as the full title runs, EL HAKIM BI-AMRILLÁH ABOO 'ALEE MANSOOR (985-1020), the sixth of the Fatimite caliphs, and the third of that dynasty ruling in Egypt, founder of the sect of the Druses, was born in 985 A.D., was designated heir apparent in 993, succeeded in 996, and died in 1020.

HAKLUYT, RICHARD, geographer, was born in or near London about 1553. Entering Christ Church, Oxford, in 1570, he fell to his intended course of reading, and by degrees perused all the printed or written voyages and discoveries that he could find. He took his degree of B.A. in 1573-74, and we learn from the Towneley MSS. that two years later he was selected twice in the same year to receive gifts of money. It is highly probable that, shortly after taking his degree of M.A. (1577), he commenced at Oxford the first public lectures in geography that "shewed both the old im-

perfectly composed and the new lately reformed mappes, globes, spheares, and other instruments of this art."

Hakluyt's first published work was his *Divers Voyages touching the Discoverie of America*. By reason of his great knowledge of these matters and his acquaintance with "the chiefest captaines at sea, the greatest merchants, and the best mariners of our nation," he was selected in 1583, at the age of thirty, to accompany Sir Edward Stafford, the English ambassador, to Paris in the capacity of chaplain. In accordance with the instructions of Secretary Walsingham, he occupied himself chiefly in collecting information of the Spanish and French movements. The first fruits of Hakluyt's labors in Paris are embodied in the most important production of his that has seen the light in modern times; it is entitled *A particular discourse concerning Westerne discoveries written in the yere 1584, by Richard Hackluyt of Oxforde*.

Hakluyt returned to England in 1584, and during his short stay he had the honor of laying before Queen Elizabeth a copy of the *Discourse* "along with one in Latin upon Aristotle's *Politicks*, which won for him, two days before his departure again for Paris, the grant of the next vacant prebend at Bristol. In the spring of the following year, feeling anxious about the reversion of the prebend, he again visited England, and exhibited in person, on May 24, 1585, before the chapter of Bristol cathedral, the queen's mandate for the coveted vacancy already signed and sealed. Before the close of the year the reversion of it fell to him, and in 1586 he was admitted to the prebend, which he held with his other preferments, till the time of his death in 1616.

HAKODADI, or HAKODATE, a seaport town of Japan, in the old province of Hokukaido, on the southern coast of the island of Zezo or Yesso. Its general position, as has been frequently remarked, is not unlike that of Gibraltar, as the town is built along the north-western base of a rocky promontory which forms the eastern boundary of a spacious bay, and is united to the mainland by a narrow sandy isthmus. It was opened to American commerce in 1854; and there are now also Danish, German and English consuls. In 1868 the town was taken by the rebel fleet, but it was recovered by the Mikado in 1869. Population, 30,000.

HAL, a town of Belgium, province of South Brabant, is situated on the Senne and the Charleroi canal, nine miles south-southwest of Brussels. It has a beautiful Gothic church of the fourteenth century, very much resorted to by pilgrims on account of a famous miracle-working image of the Virgin. Population, 7,000.

HALA, or HALLA (formerly known as Murtizábád), a town in Hyderabad district, Sind, India, situated on the Aliganj canal. Population, 5,000.

HALÁS, a corporate town of Hungary, in the megye or county of Pest-Pilis-Solt-Kis-Kun, is situated about seventy-six miles south-southeast from Budapest. Population (1890), 150,000.

HALBERSTADT, the chief town of a circle in the government district of Magdeburg, Prussian province of Saxony, is situated on the Holzemme, a tributary of the Bode, and at the junction point of four railways, twenty-nine miles southwest of Magdeburg. It has an antique appearance, and in a large number of the buildings the mediæval wood-architecture is still preserved. The population is 28,000.

HALBERT, HALBARD, a weapon consisting of an ax-blade balanced by a pick and having an elongated pike-head at the end of the staff, which was usually about five or six feet in length. Various derivations have been suggested for the term, but M. Demmin

seems to have hit the right one in the German *Halbbarthe*, "half battle-ax." The earliest halberts represented in the miniatures of the fourteenth century, or preserved in the collections of Switzerland and Germany, have the ax-blade often prolonged beyond the end of the staff, and thus resemble the English bill of the fifteenth century. The Lochaber ax may be called a species of halbert furnished with a hook on the end of the staff at the back of the blade.

HALDANE, JAMES ALEXANDER (1768–1851), whose disinterested labors in the cause of religion have secured for his name an honorable place in the ecclesiastical history of Scotland, was born at Dundee on July 14, 1768, and died on February 8, 1851.

HALDANE, ROBERT, elder brother of the preceding, and intimately associated with him in many of his labors, was born in London, February 28, 1764. In December, 1797, he joined his brother and some others in the formation of the "Society for the Propagation of the Gospel at Home;" and in building chapels or "tabernacles" for its congregations, in supporting its missionaries, and in maintaining institutions for the education of young men to carry on its work, he in the course of the twelve years which followed is stated on good authority to have expended upward of £70,000. In 1816 he visited the Continent, and first at Geneva and afterward in Montauban (1817) occupied himself in lecturing with surprising success to theological students, among whom were Malan, Monod, and Merle D'Aubigné. Returning to Scotland in 1819, he lived partly on his estate of Auchengray and partly in Edinburgh, and like his brother took an active part, chiefly through the press, in many of the religious controversies of the time. He died on December 12, 1842.

HALE, SIR MATTHEW, lord chief-justice of England, was born in 1609, at Alderley in Gloucestershire. Both his parents having died before he was five years old, the future chief-justice was placed by his guardian under the care of Mr. Staunton, vicar of Wotton-under-Edge, through whose influence he became strongly imbued with puritanical principles. There he remained till he attained his sixteenth year, when he entered Magdalen Hall, Oxford, under the tuition of the puritanical but learned Obadiah Sedgwick. At Oxford Hale devoted himself for several terms to the study of Aristotle and Calvin, with a view to holy orders, but on November 8, 1629, Hale became a member of the honorable society of Lincoln's Inn.

He was called to the bar in 1637, and almost at once found himself in full practice. Though neither a fluent speaker nor bold pleader, in a very few years he was at the head of his profession. He entered public life at perhaps the most critical period of English history. It has been said, but without certainty, that Hale was engaged as counsel for the earl of Strafford; he certainly acted for Archbishop Laud, Lord Maguire, Christopher Love, the duke of Hamilton, and others. It is also said that he was ready to plead on the side of Charles I. had that monarch submitted to the court. The parliament having gained the ascendancy, Hale signed the Solemn League and Covenant, and was a member of the famous Assembly of Divines at Westminster in 1644; but although he would undoubtedly have preferred a Presbyterian form of church government, he had no serious objection to the system of modified Episcopacy proposed by Usher. Hale took the engagement to the Commonwealth as he had done to the king, and in 1653, already serjeant, he became a judge in the Court of Common Pleas. Two years afterward he sat in Cromwell's parliament as one of the members for Gloucestershire. After the death of the Protector, however, he declined to act as a judge under Richard Cromwell, al-

though he represented Oxford in Richard's parliament. At the Restoration in 1660 Hale was graciously received by Charles II., and in the same year was appointed chief baron of the exchequer, and accepted the honor of knighthood. After holding the office of chief baron for eleven years he was raised to the higher dignity of lord chief-justice, which he held till February, 1676, when his failing health compelled him to resign. He retired to his native Alderley, where he died on December 25th of the same year.

HALES, STEPHEN, English physiologist and inventor, was born at Beckesbourn in Kent, on September 7, 1677. In March, 1717, he was elected fellow of the Royal Society, to whose *Transactions* he contributed many valuable papers. In 1732 he was named one of a committee for establishing a colony in Georgia, and the next year he received the degree of doctor of divinity. He was appointed almoner to the princess-dowager of Wales in 1750. On the death of Sir Hans Sloane in 1753, Hales was chosen foreign associate of the French Academy of Sciences. He died at Teddington, January 4, 1761.

He is celebrated as the inventor of a "ventilator," by means of which fresh air was introduced into jails, hospitals, mines, ships' holds, etc. The invention met with immediate favor, especially in France. Hales was the designer of other inventions by means of which sea-water was distilled, corn cleaned and preserved, meat preserved on long voyages, etc.

HALEVY, JACQUES FRANÇOIS FROMENTAL, a celebrated French musician, was born May 27, 1799, at Paris. He studied at the Paris Conservatoire under Berton and Cherubini, and in 1819 gained the grand prix de Rome with a cantata called *Herminie*. In accordance with the conditions of his scholarship he started for Rome, where he devoted himself to the study of Italian music, and wrote an opera and various minor works. His first opera produced in Paris after his return from Italy was called *L'Artisan*, which saw the light at the Théâtre Feydeau in 1827, apparently without much success. Other works of minor importance, and now forgotten, followed, among which only a ballet named *Manon Lascaut*, produced in 1830, deserves mention. Five years later, in 1835, Halévy produced the tragic opera *La Juive* and the comic opera *L'Éclair*, and on these works his fame is mainly founded. Both have kept the stage to the present day, and will probably survive changes of taste even greater than those which music has undergone in France during the last forty years. It is curious that the *grand-opéra*, although an essentially national product of France, was both initiated and brought to its highest perfection by two Germans—Gluck and Meyerbeer. The genius of the latter was fatal to Halévy's fame. By the side of the *Huguenots* the merits of *La Juive* appear in almost diminutive proportions. At the same time Halévy's work ought not to be treated with contempt. It is full of fine dramatic features, and especially the introduction of the Jewish element—with which Halévy, himself a Jew, was well acquainted—gives a peculiar interest on this score. *L'Éclair* is a curiosity of musical literature. It is written for two tenors and two sopranos, without a chorus, and displays the composer's mastery over the most refined effects of instrumentation and vocalization in favorable light. After these two works, to which Halévy owed his fame and his seat at the Institute, he wrote numerous operas of various *genres*. He died at Nice, March 17, 1862.

HALIBURTON, THOMAS CHANDLER (1796–1865), long a judge of Nova Scotia, and a popular literary satirist, was born at Windsor, Nova Scotia, in 1796,

and received his education there, at King's College. He was called to the bar in 1820, and took part in the legislature of his native province as a member of the House of Assembly. He distinguished himself as a barrister, and in 1828 was promoted to the bench as a chief-justice of the common pleas.

In politics Haliburton adhered through life to the Conservative party; and the influence of his early associations is traceable in most of his writings. He was still at the bar when he wrote *An Historical and Statistical Account of Nova Scotia*, in two volumes. In 1835 he contributed anonymously to a local paper a series of letters professionally depicting the peculiarities of the genuine Yankee. These sketches, which abounded in clever picturings of national and individual character, drawn with great satirical humor, were collected in 1837, and published under the title of *The Clockmaker, or Sayings and Doings of Samuel Slick of Slickville*. A second series followed in 1838, and a third in 1840. *The Attaché, or Sam Slick in England* (2 vols. 8vo), was the result of a visit there in 1841. This also was followed up by a second series in 1844. His other works include—*The Old Judge, or Life in a Colony*; *The Letter Bag of the Great Western*; *Rule and Misrule of the English in America*; *Traits of American Humor*; and *Nature and Human Nature*.

In 1840 he was promoted to be judge of the supreme court; but within two years he resigned his seat on the bench, removed to England, and after a time entered parliament as the representative of Launceston in the Conservative interest. The last time he spoke he was listened to with interest on the Canadian defenses. But the tenure of his seat for Launceston was brought to an end by the dissolution of parliament in 1865, and he did not again offer himself to the constituency. His death followed in the month of August of the same year.

HALIBUT. See HOLIBUT.

HALICARNASSUS, an ancient Greek city on the southwestern coast of Asia Minor, built on a picturesque and advantageous site at the northern end of the Ceramic Gulf or Gulf of Cos. It originally occupied only the small island of Zephyria, close to the shore, but in course of time this island was united to the mainland and the city extended so as to incorporate Salmacis, an older town of the Leleges and Carians. About the foundation of Halicarnassus various traditions were current; but they agree in the main point as to its being a Dorian colony.

HALIFAX, a sea port city of Nova Scotia (of which province it is the capital), is situated on the west side of Halifax harbor, an indentation in the southern coast of the Nova Scotia peninsula. The city was originally called Chebucto, but the name was changed to Halifax in 1749. It is situated on the declivity of a gradual slope or hill, the top of which is crowned by a strong citadel, while the harbor is protected by several forts and batteries. The streets are regularly laid out at right angles one with another, and contain many imposing and beautiful houses. Formerly the buildings were mostly of wood, but repeated destructive conflagrations have impressed upon the inhabitants the necessity of using fire-proof materials in the construction of houses, so that most modern erections have been of stone and brick. There are many notable public buildings, among them being the government house (the official residence of the lieutenant-governor of the province), the provincial building (in which are all the government offices), the postoffice and the museum; the parliament house, the admiralty house, the court house, the exchange, the cathedral of St. Mary's, the barracks, the city, military

and naval hospitals, insane asylum, jail and penitentiary. The higher educational establishments are represented by Dalhousie university and college, the Roman Catholic college (St. Mary's), Presbyterian (theological) college, and the high school. There are also numerous charitable educational institutions, two orphan asylums and a blind asylum. The lunatic asylum for the lower provinces is located here. The city has an Anglican bishop and Roman Catholic archbishop.

The material prosperity of the city is fostered by numerous manufactories, including in their products a very wide range of articles—some of the principal being machinery, iron goods and castings generally, soap, leather, rope, tobacco, paper, cotton and woolen goods, sugar, beer and spirituous liquors. There are also numbers of stores and warehouses, while the hotels are numerous and well appointed. The harbor is spacious and well protected, affording a safe anchorage for all the naval vessels of the different powers. The numerous lines of steamers furnish communication with all portions of the world, while its railway connection give it easy access to all parts of America. It has a mayor and a city government composed of aldermanic, magisterial and police departments.

Considerable fishing interests center here, and a large number of seagoing and coasting craft are owned by the citizens. The harbor is well lighted by the government light-houses, and the streets of the city are lighted with both gas and electricity. The city is a watering place of considerable reputation. The water supply for domestic use is abundant and excellent, being obtained from the neighboring lakes. A large proportion of the inhabitants are Roman Catholics. The city takes its present name from the earl of Halifax. Since it was declared a free port, in 1817, its growth in population and importance has been rapid. Population (1890), 42,000. The following facts are from the fiscal report for 1889: Total taxable values of the city, \$21,694,761; amount assessed, \$265,641; rate of taxation, 1.24. Total indebtedness of the city, \$1,824,742.46. The city has efficient fire, police and water departments.

HALIFAX, a municipal and parliamentary borough and market-town of England, in the northern division of the West Riding of Yorkshire. Halifax derives its importance from its manufactures of cloth, which began in the fifteenth century. It ranks in Yorkshire with Leeds, Bradford, and Huddersfield as a seat of the woolen and worsted manufacture. The principal staples are carpets, cashmeres, orleanses, coburgs, merinos, lastings, alpacas, damasks, baizes, broad and narrow cloths, kerseymeres, blankets, muslin-de-laines, shalloons, and figured vestings. A considerable number of persons are employed in iron-works, machine works, and chemical works, and in the neighboring coal-mines and stone quarries. The borough sends two members to parliament. The parish is the largest in Great Britain, embracing 79,200 acres. The population of the municipal and parliamentary borough is 66,000.

HALIFAX, CHARLES MONTAGUE, EARL OF, English statesman and poet, was born at Horton, Northamptonshire, in 1661. In 1682 he entered Trinity College, Cambridge, where he acquired a solid knowledge of the classics, and surpassed all his contemporaries at the university in logic and ethics, and he was one of the small band of students who assisted Newton in forming the Philosophical Society of Cambridge. His clever but absurdly panegyric poem on the death of Charles II., which was published in the *Book of Condolence and Congratulation* presented by the university to James II., secured for him the notice of the earl of Dorset, who invited him to town and introduced him to the

principal wits of the time; and in 1687 his joint authorship with Prior of the *Town and Country Mouse*, a happy parody of Dryden's *Hind and Panther*, not only increased his literary reputation, but directly helped him to political influence. In 1688, through the patronage of the earl of Dorset, he entered parliament as member for Maldon, and sat in the convention which resolved that William and Mary should be declared king and queen of England. In 1691 he was chosen chairman of the committee of the House of Commons appointed to confer with a committee of the Lords in regard to the bill for regulating trials in cases of high treason; and he displayed in these conferences such tact and debating power that he was made one of the commissioners of the treasury and called to the privy council. Although perhaps it was inevitable that England should sooner or later adopt the continental custom of lightening the annual taxation in times of war by contracting a national debt, the actual introduction of the expedient was due to Montague, who on December 15, 1692, proposed to raise a million sterling by way of loan. In the spring of 1694 Montague introduced a bill for the incorporation of the bank of England. The bill, after some opposition, passed the House of Lords in May, and immediately after the prorogation of parliament Montague was rewarded by the chancellorship of the exchequer. In the following year he was returned for the borough of Westminster to the new parliament. His other expedients for meeting the emergencies of the financial crisis were equally successful, and the rapid restoration of public credit secured him a commanding influence both in the House of Commons and at the board of the treasury; but although Godolphin resigned office in October, 1696, the king hesitated for some time between Montague and Sir Stephen Fox as his successor, and it was not till 1697 that the former was appointed first lord. In 1698 and 1699 he acted as one of the council of regency during the king's absence from England. In February of the former year he had been accused of peculation in connection with the issue of exchequer bills, but had been triumphantly acquitted, and his reputation was still further increased in the same year by the extraordinary popularity of his project for a new East India company. After the return of the king in 1699 he resigned his offices in the government and succeeded his brother in the auditorship. On the accession of the Tories to power he was removed in 1701 to the House of Lords, by the title of Lord Halifax. In the same year he was impeached for malpractices along with Lord Somers and the earls of Portland and Oxford, but all the charges were dismissed by the Lords; and in 1703 a second attempt to impeach him was unsuccessful. He continued out of office during the reign of Queen Anne, but in 1706 he was named one of the commissioners to negotiate the union with Scotland; and after the passing of the act of settlement in favor of the house of Hanover, he was appointed ambassador to the elector's court to convey the insignia of order of the garter to George I. On the death of Anne (1714) he was appointed one of the council of regency until the arrival of the king from Hanover; and after the coronation he received the office of first lord of the treasury in the new ministry, being at the same time created earl of Halifax and Viscount Sunbury. He died on May 15th of the following year, and left no issue.

HALIFAX, GEORGE SAVILE, MARQUIS OF, English statesman and author, was born about 1630. He succeeded to the baronetcy on the death of his father, and, having taken an active part in the Restoration, he was in 1667 created Baron Savile and Viscount Halifax. In June, 1672, he was sent to negotiate terms of peace

with France, but he was kept in ignorance of the agreement between Charles and Louis in regard to the establishment of popery in England. In 1679 he was created an earl, and having become a member of the new council after the fall of Danby, he differed from the earl of Shaftesbury and his other colleagues in reference to the Exclusion Bill, and by an extraordinary manifestation of nearly all the resources of oratory was instrumental in causing its rejection by the Lords.

In 1682 he was created a marquis and became lord privy seal. Although chiefly instrumental in securing the duke of York's succession, his proposed limitations of James' authority when the crown should devolve upon him, as well as his subsequent leaning to Whig principles, awakened the duke's settled hostility, and this was further deepened by his exposure of the malversation of the earl of Rochester. After the accession of James he was accordingly removed from the office of privy seal to that of president of the council, a less important position; and when in 1685 he refused to give his vote for the repeal either of the Test Act or of the Habeas Corpus Act, he was dismissed from the cabinet. In the Convention Parliament he was chosen speaker of the Lords, and strongly opposed the motion for a regency. He died somewhat suddenly, April 20, 1695. He was succeeded by his son William, with whose death in 1699 the title became extinct in his family. A daughter by his second marriage was the mother of the fourth and celebrated earl of Chesterfield; and from his natural son, Henry Carey the dramatist, was descended the celebrated Edmund Kean.

Halifax is portrayed in Dryden's *Absalom and Achitophel* as—

“Jotham of piercing wit and pregnant thought,
Endued by nature and by learning taught
To move assemblies.”

HALL, a town in northern Tyrol, Austria, government district of Innsbruck, is picturesquely situated between two mountains on the left bank of the Inn, which is navigable there, and on the railway from Rosenheim to Innsbruck. Population (1890), 6,000.

HALL (generally known as Swabian Hall), a town of Würtemberg, circle of Jagst, is situated in a deep valley on both sides of the Kocher, thirty-five miles north-east of Stuttgart. Population (1890), 10,000.

HALL, BASIL (1788-1844), British traveler and miscellaneous writer, was born at Edinburgh, December 31, 1788. Basil Hall was educated at the high school of Edinburgh, and in 1802 entered the navy, where he rose to the rank of post-captain in 1817. In 1816 he commanded the sloop *Lyra*, which accompanied Lord Amherst's embassy to China; and in this vessel he performed the cruise which he describes in the most popular and perhaps the most interesting of his works—*An Account of a voyage of Discovery to the West Coast of Corea and the Great Loo-choo Island in the Japan Sea* (London, 1818). In 1820 he held a command on the Pacific coast of America, and in 1824 published two volumes of *Extracts from a Journal written on the Coasts of Chili, Peru, and Mexico in the years 1820-21-22*. Retiring on half-pay in 1824, Hall in 1825 married a daughter of Sir John Hunter, and in her company traveled (1827-28) through the United States. In 1829 he published his *Travels in North America in the years 1827 and 1828*, a book almost as well-known as his first, less from its intrinsic merit than from the violence with which it was assailed by the American press for its views of American society. *Schloss Hainfeld, or a Winter in Lower Styria* (1836), is partly a romance, partly a description of a visit paid by the author to the castle of the Countess Purgstall. *Spain and the Seat of War in Spain* appeared in 1837. The *Fragments of Voyages*

and Travels (9 vols.) were issued in three detachments between 1831 and 1840. Captain Hall was a fellow of the Royal Societies of London and Edinburgh, and a member of the Astronomical Society of London, and left a number of scientific and miscellaneous writings besides those mentioned. His last work, a collection of sketches and tales under the name of *Patchwork* (1841), had not been long published before its author was seized with insanity, from which he was only released by his death, in Haslar Hospital, Portsmouth, September 11, 1844.

HALL, CHARLES FRANCIS, an Arctic explorer, was born at Rochester, N. H., in 1821. After following the trade of blacksmith he became a journalist in Cincinnati, but his enthusiasm for Arctic exploration led him in 1859 to volunteer to the American Geographical Society to go in search of the bones of Franklin. With the proceeds of a subscription he was equipped for his modest expedition, and obtained a passage in May, 1860, on board a New London whaling vessel, commanded by Captain Buddington, the same who had picked up the English search-ship *Resolute*. The whaler having become blocked up with ice, Hall took up his abode with the Eskimo, living with them for two years, adopting their habits and acquiring their language, making special friends of two natives, man and wife, who had been in England, and knew something of our language. He wandered about with the Eskimo in the region to the north of Hudson's Bay, acquiring much information, especially about the people. He published an account of his experiences in 1864, under the title of *Arctic Researches, and Life among the Esquimaux*. Having learned little or nothing, however, about the fate of the Franklin expedition, he returned in 1864, remaining among the Eskimo till 1869. Unfortunately, the full journal he kept of his five years' wanderings has never been published. The expedition which brought Hall most prominently into notice was fitted out in 1871, in the steamer *Polaris*, which was sent out at the expense of the United States Government, its object being to reach the supposed open Polar Sea, and if possible attain the Pole. Hall was in command, while Buddington was sailing master. There was a modest but competent scientific staff, and among the crew were Hall's two old Eskimo friends, who had become devoted to him. On June 29, 1871, the *Polaris* left New York, and making a remarkably rapid passage up Davis Straits and Smith Sound, reached on August 30th the latitude of 82° 16' N., until the last English expedition the highest northern latitude reached of which there is any authentic report. Hall and most of the officers and crew were for proceeding onward, but they were overruled by Buddington, and went into winter quarters in a sheltered cove on the Greenland coast, named Polaris Bay, in 81° 38' N. On October 24 Hall, returned from a successful sleigh expedition to the north and was suddenly seized by an illness, of which he died on November 8. As there were some suspicions of poison, an inquiry was made by the navy department, who found that there was no proof of foul play. Captain Buddington, on whom the command devolved, determined in August of 1872 to return, but the *Polaris* was greatly hampered by the ice. The danger became so great that on October 15 boats and stores were put on the ice, on which nineteen of the crew had disembarked. Suddenly the ship broke away, and the party on the ice drifted slowly southward for 195 days, and were picked up off the coast of Labrador, by a whaling steamer, 2,000 miles from where they had parted with the *Polaris*. The party in the ship reached Littleton's Island, where they passed the winter, building two boats from the boards of the vessel, in which they set

sail southward in June, 1873. On the twenty-third of that month they were picked up by a Dundee whaler, and were taken to that town, from which they ultimately reached the United States. The scientific results of the unfortunate Hall's last expedition were of considerable importance, and have been published by the United States Government, as also has an independent account in German by Dr. Bessels, one of the scientific staff.

HALL, or HALLE, EDWARD, an English lawyer who takes high rank among the earlier narrators of his country's history, was born in London about the close of the fifteenth century, and died in 1547, the year of the death of King Henry VIII.

HALL, JAMES (1793-1868), an American judge and the author of a number of books chiefly relating to the Western States, was born at Philadelphia, August 19, 1793. In 1820 he removed to Shawneetown, Ill., where he commenced practice at the bar and also edited the *Illinois Gazette*. Soon after he was appointed public prosecutor of the circuit, and in 1824 became a judge. On the abolition of the latter office four years afterward he was appointed State treasurer, but he continued at the same time his legal practice and also edited the *Illinois Intelligencer*. Subsequently he became editor of the *Western Souvenir*, an annual publication, and of the *Illinois Monthly Magazine*, afterward the *Western Monthly Magazine*. He died near Cincinnati, July 5, 1868.

HALL, JOSEPH, bishop of Norwich, one of the wittiest as well as wisest writers of his century, was born at Bristow Park, Leicestershire, July 1, 1574. Having taken holy orders, he in 1601 became rector of Halstead in Suffolk, near Bury St. Edmunds. In 1612 Hall was presented to the curacy of Waltham Holy-Cross, in Essex, and about the same time received the degree of doctor of divinity. Meanwhile his talents as a preacher, and the ability shown in his controversial writings, had brought him into notice at court. He was appointed chaplain to Prince Henry and prebendary of Wolverhampton. The latter dignity he soon resigned. In 1616 Hall accompanied the earl of Carlisle on his mission to France, but was compelled by illness to return; in 1617 he went with James I. into Scotland, and in 1618 was appointed by him one of the English deputies to the Synod at Dort; but he was again forced by sickness to return before the business of the assembly was finished. The year before (1617) he had been appointed dean of Worcester. In 1624 he refused the see of Gloucester, but in 1627 became bishop of Exeter. No better proof of his attachment to the Church of England is needed than his *Episcopacy by Divine Right Asserted*, written in 1640 at the suggestion of Laud. In 1641 Hall was translated to the see of Norwich. The same year he joined eleven other bishops in presenting to parliament a protest against all laws passed in their enforced absence. Upon this the bishops were accused of high treason and thrown into the Tower. Hall, in his *Hard Measure*, relates the trials he underwent both at this time and afterward. The accusation fell to the ground, and in six months the bishops were released (June 1642), only, however, on each finding security for £5,000. Hall proceeded to Norwich, which he had not yet visited, and set about his pastoral duties; but in 1643 his revenues and personal property were sequestered by parliament, a nominal allowance of £400 a year being made for his maintenance.

HALL, MARSHALL, the discoverer of the "diastaltic nervous system," was born at Basford, Notts, February 18, 1790. His father, Robert Hall, is well known as the introducer of the modern processes of bleaching on a large scale. He graduated in medicine, and after practicing for some time and writing several medical

treatises, pursued more especially his studies of the effects of blood-letting, and his *Researches* (issued in 1830) were acknowledged by the medical profession to be of vast practical value. Much practical good also resulted from his warning against mistaking exhaustion for inflammation. Hall married in 1829, and the same year he made the discovery which placed him in rank with Harvey. It is described in *A Critical and Experimental Essay on the Circulation of the Blood in the Capillary Vessels*, in which he showed that the blood-channels intermediate between arteries and veins serve the office of bringing the fluid blood into contact with the material tissues of the system. About this time he made his original investigations on quantity of respiration, detailed in *The Inverse Ratio which subsists between the Respiration and Irritability in the Animal Kingdom*, a work which led to the treatises on hibernation. In 1831 he proposed a simple and bloodless operation for the removal of vascular nævus. His most important discovery in physiology was the "diastaltic spinal system," his views being embodied in a paper on *The Reflex Function of the Medulla Oblongata and the Medulla Spinalis*, 1832, in which year he was elected fellow of the Royal Society, London. This paper was supplemented in 1837 by another *On the True Spinal Marrow, and the Excito-motor System of Nerves*, in which he explained the real classification and distribution of the entire nervous system. Hall thus became the authority on the multiform deranged states of health referable to an abnormal condition of the nervous system, and he made plain the obscure class of convulsive affections. The action of strychnia as a spinal tonic or excitant, the relief of the epileptic, tracheotomy in laryngismal epilepsy, and the "ready method" in asphyxia, were among the later objects of his investigation. His "ready method"—sometimes called Marshall Hall's method—for resuscitation in drowning and other forms of suspended respiration—is perhaps the most popular of his discoveries; by it innumerable lives have been preserved. Doctor Hall lectured at various medical schools, at the College of Physicians, and also at New York during his American tour. His papers in medical and scientific journals, including the *Comptes Rendus*, are remarkable for lucidity and brevity. He died at Brighton of a throat affection, aggravated by lecturing, August 11, 1857.

HALL, ROBERT, one of the greatest of English pulpit orators, was born May 2, 1764, at Arnsby near Leicester. On August 13, 1780, he was set apart to the ministry, and in 1781, in accordance with the provisions of an exhibition which he held, he entered King's College, Aberdeen, where he took the degree of master of arts in March, 1785. At the university he was without a rival of his own standing in any of the classes, distinguishing himself alike in classics, philosophy and mathematics. July, 1790, he accepted an invitation to make trial of a congregation at Cambridge, of which he became pastor in July of the following year. It was during his Cambridge ministry, which extended over a period of fifteen years, that his oratory was most brilliant and most immediately powerful. In 1793 he expounded his political sentiments in a powerful pamphlet entitled an *Apology for the Freedom of the Press*, which at once obtained an extensive circulation, and doubtless to some extent aided in the formation of that public opinion which has given birth in England to the present remarkable era of gradual and unswerving political progress. From his first attack of insanity, which occurred in November, 1804, he recovered so speedily that he was able to resume his duties in April, 1805, but a more severe recurrence of the malady rendered it advisable for him on his second recovery to re-

sign his pastoral office, which he did in March, 1806. On leaving Cambridge he paid a visit to his relatives in Leicestershire, and then for some time resided at Enderby, preaching occasionally in some of the neighboring villages. In the autumn of 1807 he changed his residence from Enderby to Leicester, and in 1808 he married the servant of a brother minister. His proposal of marriage had been made after an almost momentary acquaintance, and, according to the traditionary account, in very abrupt and peculiar terms. His writings at Leicester embraced various tracts printed for private circulation; a number of contributions to the *Eclectic Review*, among which may be mentioned his articles on *Foster's Essays* and on *Zeal without Innovation*. He died February 21, 1831.

HALLA. See HALA.

HALLAM, HENRY, the celebrated English historian, was born at Windsor in the year 1777,—some authorities make the date one year later,—and died at Pickhurst, Kent county, on January 21, 1859. Notwithstanding his great fame and recent death very little seems to be known of the personal history of Hallam. He was the son of a dean of Bristol, and was educated at Eton, and afterward went to Christ Church, Oxford, where he took his degree in 1799. He was called to the bar by the Inner Temple, and afterward became a bencher of that society, but he does not appear to have at any time attempted to obtain practice. Early in life he devoted himself to literary work, and became connected with the brilliant band of authors and politicians who then led the Whig party. He took no active part in practical politics, and was in fact unsuited by nature for the rough work of party polemics. But he was an active supporter of many popular movements—particularly of that which ended in the abolition of the slave trade; and he was throughout his entire life sincerely and profoundly attached to the political principles of the Whigs, both in their popular and in their aristocratic aspect. Hallam's earliest literary work was undertaken in connection with the great organ of the Whig party, the *Edinburgh Review*, where his review of Scott's *Dryden* attracted much notice. His first great work, *The View of the State of Europe during the Middle Ages*, was produced in 1818, and was followed nine years later by the *Constitutional History of England*. In 1838–39 appeared the *Introduction to the Literature of Europe in the Fifteenth, Sixteenth, and Seventeenth Centuries*. These are the three works on which the fame of Hallam rests. They at once took a place in English literature which has never been seriously challenged. A volume of supplemental notes to his *Middle Ages* was published in 1848. These facts and dates represent nearly all the events of Hallam's career. The strongest personal interest in his life was the affliction which befell him in the loss of his children, one after another. His eldest son, Arthur Henry Hallam,—the "A. H. H." of Tennyson's *In Memoriam*, and by the testimony of his contemporaries a man of the most brilliant promise,—died in 1833 at the age of twenty-two. Seventeen years later, his second son, Henry Fitzmaurice Hallam, was cut off like his brother at the very threshold of what might have been a great career. The premature death and high talents of these young men, and the association of one of them with the most popular poem of the age, have made Hallam's family afflictions better known than any other incidents of his life. He survived wife, daughter, and sons by many years. In 1834 Hallam published *The Remains in Prose and Verse of Arthur Henry Hallam, with a Sketch of his Life*. In 1852 a selection of *Literary Essays and Characters* from the *Literature of Europe* was published. Hallam was a fellow of the Royal

Society, and a trustee of the British Museum, and enjoyed many other appropriate distinctions. In 1830 he received the gold medal for history, founded by George III.

HALLE (formerly called, to distinguish it from other towns of the same name, Halle in Sachsen, but now generally known as Halle an der Saale), a city of Prussian Saxony, government district of Merseburg, is situated on the right bank of the Saale and at the junction of six railways, twenty miles northwest of Leipsic. It consists of the old town, or Halle proper, with five suburbs, and the two small towns of Glauchau and Neu-markt, which were added to it in 1817. Halle is under the immediate jurisdiction of the crown, and is the seat of the imperial chief office of mines for the provinces of Saxony, Brandenburg and Pomerania, of a head tax-office, of a circle court and a provincial office. Its well-known university was founded by King Frederick I. in 1694 in behalf of the jurist Thomasius, whom many students followed to Halle when he was expelled from Leipsic through the enmity of his fellow professors. It was closed by Napoleon in 1806 and again in 1813; and in 1815 it was united with that of Wittenberg. It has faculties of theology, law, medicine and philosophy. From the beginning it has been recognized as one of the principal schools of Protestant theology, and has numbered among its professors some of the most eminent names of Germany. Its maximum number of students occurred in 1829, when they exceeded 1,300. Subsequently the number declined below 600, but at present the average attendance is between 900 and 1,000. The present buildings were erected in 1834. In connection with the university there are a botanical garden, a theological and normal seminary, a medical and surgical clinical institute, a maternity hospital, an observatory, and a library of over 100,000 volumes, which also contains collections of coins and engravings. In 1859, a bronze statue was erected in the market-place to Handel, who was born at Halle in 1685; and in the outskirts of the town there is a monument to the Germans who fell at the battle of Leipsic in 1813. The salt-springs of Halle have been known from a very early period. Some rise within the town, and others on an island in the Saale; and together their annual yield of salt is about 12,000 tons. The workmen employed in connection with the manufacture are a peculiar and distinct race known by the name of *Halloren*, probably descended from an old Frankish colony. They observe several ancient customs, and enjoy certain special exemptions and privileges. Population (1890), 76,000.

HALLECK, FITZ-GREENE, an American poet, was born at Guildford, Conn., July 8, 1790. By his mother he was descended from John Eliot, the "Apostle of the Indians." At an early age he became clerk in a store at Guildford, and at eighteen he entered a banking house in New York. Having made the acquaintance of Joseph Rodman Drake in 1819, he assisted him under the signature of "Croaker junior" in contributing to the *New York Evening Post* the humorous series of "Croaker Papers." In 1821 he published his longest poem, *Fanny*, a satire on local politics and fashions in the measure of Byron's *Don Juan*. He visited Europe in 1822-1823, and after his return published anonymously in 1827 a volume of poems in which were included *Alnwick Castle* and *Burns*. From 1824 to 1849 he was confidential agent of John Jacob Astor, who named him one of the trustees of the Astor library. In 1864 he published in the *New York Ledger* a poem of 300 lines, entitled "Young America." He died at Guildford, November 19, 1867. The poems of Halleck are written with great care and finish, and manifest the possession of a fine sense of harmony and of genial and elevated sentiments.

HALLECK, HENRY WAGER, an American general, was born at Waterville, Oneida county, N. Y., January 15, 1815. After studying a short time at Union College, he in 1835 entered the West Point military academy, whence he was in 1839 promoted to the army as second lieutenant in the corps of engineers, being at the time appointed assistant professor of engineering at the academy. In the following year he was made an assistant to the board of engineers at Washington, and from 1841 to 1844 he was employed in connection with the fortification of New York harbor. In 1845 he was sent by the government to examine the principal military establishments of Europe, and during his absence he was promoted to the rank of first lieutenant. After his return he in the winter of 1845-1846 delivered at the Lowell Institute, Boston, a course of twelve lectures on the science of war, published in 1846 under the title *Elements of Military Art and Science*, and republished with additions in 1861. On the outbreak of the Mexican war in 1846, he as military engineer, accompanied the expedition to California and the Pacific coast, where he distinguished himself not only as an engineer, but by his administrative skill as secretary of state, and by his presence of mind and bravery in several skirmishes with the enemy. In 1847 his services were recognized by promotion to the rank of captain. He continued for several years to act on the staff of General Riley in California, holding at the same time the office of secretary of state of the territory; and he took a leading part in framing the State constitution of California, on its being admitted into the union. In 1852 he was appointed inspector and engineer of lighthouses, and in 1853 he was promoted captain of engineers. In 1854 he resigned his commission to practice law, and so great was his success in his profession that the firm of which he was senior partner soon obtained one of the largest legal businesses in the State. On the outbreak of the civil war he was in August, 1861, appointed major-general of the United States army, and in the following November was appointed commander of the western department. In July of the same year he was appointed general-in-chief of the armies of the United States—a position he held till March, 1864, when he was succeeded by Grant and was appointed chief of the staff. In April, 1865, he held the command of the military division of the James, and in August of the same year of the military division of the Pacific, which he retained till March, 1869, when he was transferred to that of the South, a position he held till his death at Louisville, January 9, 1872. The military record of General Halleck, especially in relation to his conduct of the affairs of the position of commanding general, has been the subject of acrimonious discussion, *pro* and *con*, some authorities going to the length of accusing him of incapacity, injustice, and actions but little short of treason. These questions are yet, and probably always will be, open and unsettled.

HALLER, ALBRECHT VON, one of the greatest of the anatomists and physiologists of the eighteenth century, was born at Bern, Switzerland, October 16, 1708. When still hardly fifteen he was already the author of numerous metrical translations from Ovid, Horace and Virgil, as well as of original lyrics, dramas, and an epic of four thousand lines on the origin of the Swiss confederation. In his sixteenth year he entered the university of Tübingen (December, 1723), where he studied under Camerarius and Duvernoy. Dissatisfied with his progress, he, in 1725, exchanged Tübingen for Leyden, where Boerhaave was in the zenith of his fame, and where Albinus had already begun to lecture in anatomy. At that university he graduated in May, 1727, undertaking successfully in his thesis to prove that the

so-called salivary duct, claimed as a recent discovery by Coschwitz, was nothing more than a blood-vessel. Haller then visited London and Paris, where he studied under Ledran and Winslow; and in 1728 proceeded to Basel, where he devoted himself to the study of the higher mathematics under John Bernoulli. It was during his stay there also that his first great interest in botany was awakened; and, in the course of a tour through Savoy, Baden, and several of the Swiss cantons, he began a collection of plants which was afterward the basis of his great work on the flora of Switzerland. In 1729 he returned to Bern and began to practice as a physician; his best energies, however, were devoted to the botanical and anatomical researches which rapidly gave him a European reputation, and procured for him from George II., in 1736, a call to the chair of medicine, anatomy, botany, and surgery, in the newly founded university of Göttingen. The quantity of work achieved by Haller in the seventeen years during which he occupied the post was immense. Apart from the ordinary work of his classes, which entailed upon him the task of newly organizing a botanical garden, an anatomical theater and museum, an obstetrical school, and similar institutions, he carried on without interruption those original investigations in botany and physiology, the results of which are preserved in the numerous works associated with his name. Notwithstanding all this variety of absorbing interests, he never felt at home in Göttingen; his untraveled heart kept ever turning toward his native Bern (where he had been elected a member of the great council in 1745), and in 1753 he resolved to resign his chair and return to Switzerland. About 1773 the state of his health rendered necessary his entire withdrawal from public business; for some time he supported his failing strength by means of opium, on the use of which he communicated a paper to the *Proceedings* of the Göttingen Royal Society in 1776; the excessive use of the drug is believed, however, to have hastened his death, which occurred on December 17, 1777.

HALLEY, EDMUND, an eminent astronomer, was born near London, October 29, 1656. Before leaving school for Queen's College, Oxford, which he entered as commoner in 1673, he had observed the change in the variation of the compass, and, at the age of nineteen, he supplied a new and improved method of determining the elements of the planetary orbits. His detection of considerable errors in the tables then in use led him to the conclusion that a more accurate ascertainment of the places of the fixed stars was indispensable to the progress of astronomy; and, finding that Flamsteed and Hevelius had already undertaken to catalogue those visible in northern latitudes, he assumed to himself the task of making observations in the southern hemisphere, and, in November, 1676, he embarked for St. Helena. On the voyage he noticed the retardation of the pendulum in approaching the equator; and during his stay on the island he observed the transit of Mercury, which suggested to him the important idea of employing similar phenomena for the calculation of the solar distance. He returned to England in November, 1678, having by the registration of 360 stars won the title of the "Southern Tycho," and by the translation to the heavens of the "Royal Oak," earned a degree of master of arts, conferred at Oxford by the king's command, December 3, 1678, almost simultaneously with his election as fellow of the Royal Society. In Paris he observed, with Cassini, the great comet of 1680 after its perihelion passage. He now engaged chiefly upon lunar observations, with a view to the great desideratum of a method of finding the longitude at sea. His mind, however, was also busy with the momentous problem of

gravity. Having reached so far as to perceive that the central force of the solar system must decrease inversely as the square of the distance, and applied vainly to Wren and Hooke for further elucidation, he made, in August, 1684, that journey to Cambridge for the purpose of consulting Newton, which resulted in the publication of the *Principia*.

In 1696 he was, although a zealous Tory, appointed comptroller of the mint at Chester, and (August 19, 1698) he received a commission as captain of the *Paramour Pink*, for the purpose of making extensive observations on the conditions of terrestrial magnetism. This task he accomplished in a voyage which lasted two years, and extended to the 52d degree of S. latitude. The results were published in a *General Chart of the Variations of the Compass* in 1701; and immediately afterward he executed, by royal command, a careful survey of the tides and coasts of the British channel, an elaborate map of which he produced in 1702. On his return from a journey to Dalmatia, for the purpose of selecting and fortifying the port of Trieste, he was nominated, November, 1703, Savilian professor of geometry at Oxford, and received an honorary degree of doctor of laws.

Between 1713 and 1721 he acted as secretary to the Royal Society, having previously during eight years (1685-93) filled the same office, and early in 1720 he succeeded Flamsteed as astronomer-royal. Although in his sixty-fourth year, he undertook to observe the moon through an entire revolution of her nodes (eighteen years), and actually carried out his purpose. He died in the full possession of his faculties, January 14, 1742, at the age of eighty-five.

HALLOWEVEN or HALLOWE'EN, the vigil of Hallowmas or All Saints' Day. For some account of the singular observances by which it used to be, and to some extent still is, distinguished in Scotland and elsewhere, reference may be made to such works as Brand's *Popular Antiquities*, Chambers' *Book of Days*, or better still to the well-known poem of Burns. Though sometimes neglected in modern practice, the most essential part of Hallowe'en ritual seems to consist in the lighting by each household of a bonfire at nightfall. This points to the very ancient and widely diffused practice of kindling sacred fires at certain seasons of the year. While the Germanic nations had their Osterfeuer and Johannisfeuer, the Celtic had their Bealtine or Beil-tine (see BELTANE) and Samhtheine, the former on the eve of May 1, and the latter on the eve of November 1. Probably the winter as well the summer festival was from the beginning regarded as a season at which the fairies were both unusually active and unusually propitious; but there is no evidence to show that the methods of divination at present usually resorted to, although of great antiquity, were originally regarded as limited in their efficacy to any one day.

HALLUIN, a town of France, in the department of Nord and arrondissement of Lille, is situated near the right bank of the Lys. Population (1890), 10,000.

HALMSTAD, the chief town of the Swedish län Halland or Halmstad, is situated on the east shore of the Cattegat, about seventy-six miles south-southeast of Gothenburg, and the mouth of the river Nissa. The castle is the residence of the governor of the province. Population (1890), 8,000.

HALO, a luminous circle of light surrounding one of the heavenly bodies. A better definition perhaps would be "a ring of colored light formed by refraction, on the passage of light from one of the heavenly bodies through the aqueous vapor surrounding the earth." This would include coronæ and rainbows, and similar phenomena.

Halos may be divided into the following classes. They are usually seen surrounding the sun or the moon, but in the tropics small halos were observed by Humboldt round the planet Venus:

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| 1. Encircling..... | { A. Simple. |
| | { B. Compound, <i>i.e.</i> , halo systems. |
| | { C. Coronæ. |
| 2. Opposite. | { α . Rainbows. |
| | { β . Fog-bows and mist halos. |
| | { γ . Mountain specters. |

Halos of the classes A and B are generally attributed to refraction and reflection of the rays of light by the presence of minute snow crystals in the upper strata of the air, and they occur usually when cirrus or cirro-stratus clouds exist. This theory was originated by Descartes, and was adopted by Marriotte (in 1686), and subsequently followed by Doctor Young and Sir Isaac Newton. It is, however, probable that some halos and certainly all coronæ (class C) are formed by refraction of light from globules of water suspended in the atmosphere. Simple halos are either about twenty-two and one-half degrees or forty-seven degrees in diameter. The ice or snow crystals, being hexagonal in form, sometimes produce a double refraction, and then the large and small halos are seen at the same time, and, reflexion taking place from the surfaces of the crystals, additional halos or parts of halos are formed.

At the points of intersection of the halos, images of the sun or moon sometimes appear; when seen with the former, they are called *parhelia* or *mock-suns*, and when with the latter, *paraselenæ* or *mock-moons*. They are sometimes accompanied with flaming tails, and are usually of prismatic colors, as also are the halos and coronæ. The latter are seen when fleecy clouds or mist intervene between the spectator and the sun or moon, to which they are in immediate proximity, thereby being distinguished from the halos, which are formed at a distance from those luminaries. The predominating color in coronæ is red or orange.

The second principal division of halos includes those which are seen opposite to the sun and moon. The first class of these comprises rainbows, which are occasioned by refraction of the light from the sun or moon, produced by falling rain, causing a bow with the prismatic colors in concentric bands and arranged as they appear in the solar spectrum. When the rain is abundant an inner bow is formed, the colors in which are in inverted order. Rainbows, when seen from mountain tops and the topmasts of ships, are completely circular. Fog-bows and mist halos are somewhat similar. Mist halos are seen in the vapor of fountains or waterfalls, and resemble rainbows. Mountain specters are caused by reflexion, and often appear accompanied by chromatic halos. They generally occur on mountains when the sky between the observer and the sun is clear and there is a mist or cloud on the side of the mountain opposite to the sun, on which the summit of the mountain and the buildings and persons standing near are reflected. The most notable of mountain specters is that of the Brocken, in the Harz mountains.

Many of the ancient descriptions of miraculous appearances in the heavens may be attributed to the phenomena before mentioned. Among the chief of these is the appearance of a cross which the emperor Constantine alleged he saw in the heavens about noon when marching against Maxentius (about 313 A.D.), and which was the cause of his conversion to christianity. Some writers have doubted the occurrence; but it is quite possible Constantine saw part of a system of solar halos, and two of these at right angles would form a cross.

HALS, FRANS, was born at Antwerp according to most authorities in 1584, and died at Haarlem in 1666.

As a portrait painter second only to Rembrandt, he displayed extraordinary talent and quickness in the exercise of his art coupled with improvidence in the use of the means which that art secured to him.

HALSTEAD, a market-town of England, county of Essex, is situated on the Colne Valley Railroad and on a steep acclivity rising from the river Colne, forty-eight miles northeast of London. Population, 7,000.

HALYBURTON, THOMAS, a distinguished Scottish divine, was born at Dupplin, near Perth, December, 1674; and died in 1712.

HAM (חַם), of whose position in order of birth there has been much dispute, is usually spoken of as the second son of Noah, and the progenitor of Cush, Mizraim, Phut, and Canaan. On the assumption that these early genealogies are geographical rather than personal or even ethnological, the name Ham, which in Hebrew radically signifies "hot," would seem to indicate the torrid zone; and this inference, though not supported, so far as has been hitherto discovered, by any corresponding explanation of the names of Shem and Japheth, at least harmonizes well with the fact that on the whole Shem seems intended to denote the intermediate and Japheth the northern regions of the world as known to the compiler of the book of Genesis.

HAM, a small town of France, in a marshy district on the left bank of the Somme, about forty miles southeast of Amiens, on the railway between Amiens and Rheims. It had in 1876 a population of only 3,122; but historically it is a place of very considerable importance. From the ninth century onward it appears as the seat of a lordship which, after the extinction of its hereditary line, passed in succession to the houses of Coucy, Enghein, Luxembourg, Rohan, Vendôme, and Navarre, and was finally united to the French crown on the accession of Henry IV. The castle, founded by Odo in the twelfth century, was rebuilt in the thirteenth and extended in the fourteenth, and its present appearance is mainly due to Louis of Luxembourg, count of St. Pol, who between 1436 and 1470 not only furnished it with outworks, but gave such a thickness to the towers and curtains, and more especially to the great tower or donjon which still bears his motto *Mon Myeux*, that they would offer a long resistance even to modern artillery. It forms a rectangle 395 feet long by 263 feet broad, with a round tower at each angle and two square towers protecting the curtains. The eastern and western sides are each defended by a demi-lune. The Constable's Tower, for so the great tower is usually called in memory of St. Pol, has a height of about 100 feet, and the thickness of the walls is thirty-six feet; the interior is occupied by three large hexagonal chambers in as many stories. As the castle of Ham has frequently been used as a state prison both in ancient and modern times, the list of those who have tasted its hospitality is an interesting one, including Joan of Arc, Louis of Bourbon, the ministers of Charles X., Louis Napoleon, Cavaignac, and Lamoricière. Louis Napoleon was there for six years, and at last effected his escape in the disguise of a workman. During 1870-71 Ham was several times captured and recaptured by the belligerents.

HAMADAN, a town of Persia, in the province of Irak-Adjemi, 162 miles west-southwest of Teheran, in the district of the Djebal at the foot of the Elvend or Arwand Mountain, the Orontes of the ancients. It is a busy place of about 50,000 inhabitants, and has large and well-stocked bazaars.

HAMAH, the Hamath of the Bible, one of the oldest cities of Syria, situated in the valley of the Orontes, 110 English miles north of Damascus. It finds a place

among the northern boundaries of the Holy Land and is frequently mentioned in Old Testament history.

HAMANN, JOHANN GEORG, a distinguished writer on philosophical and theological subjects, was born at Königsberg, Prussia, in 1730, and died in 1788.

HAMÂSAH (more correctly HAMÂSEH), the name of a famous Arabian anthology compiled by Habîb ibn Aus et-Tâi, surnamed Abû Temmâm, (corruptly ABUTEMAN, *q.v.*) The collection is so-called from the title of its first book. It consists of ten books or parts, containing in all 884 poems or fragments of poems.

HAMBATO, a form of the name AMBATO, (*q.v.*)

HAMBURG, a state of the German empire, which consists of the city of Hamburg with its incorporated suburbs of St. George's and St. Paul's, the surrounding district with the sixteen suburban hamlets (*Vororte*), several islands in the Elbe, the five enclaves of Volksdorf, Hansdorf, etc., in Holstein, the communes of Moorburg in Lüneburg and Cuxhaven-Ritzbüttel, in the northwest of the duchy of Bremen at the mouth of the Elbe, the island of Neuwerk about five miles from the coast, and the bailiwick (*amt*) of Bergedorf, which up to 1867 was held in common by Lübeck and Hamburg. The whole territory has an area of 157.18 square miles, exclusive of ninety-nine square miles occupied by the Elbe. Of this area one hundred and twenty-four square miles are within the limits of the German customs, but the rest continues to be practically "abroad" in relation to the commerce of the empire. In 1878 the total population was 417,239, and in 1890, 575,276.

HAMBURG, one of the most remarkable cities of Germany, and indeed of Europe, ranking as it does as the first of all the seats of commerce on the continent, is situated on the right bank of the northern arm of the Elbe, about ninety-three miles from the mouth of that river, just where it is joined by the Alster and the Bille. Were it not for political and municipal boundaries Hamburg might be considered as forming one town with Altona and Ottensen, the three presenting to the river a continuous frontage of nearly four miles; and long lines of suburbs radiate inland in various directions. The city proper lies on both sides of the Alster, which, having been dammed up a short distance from its mouth, now forms a considerable lake, of which the southern portion, within the line of the fortifications bears the name of the Inner Alster, and the other and larger portion (2,300 meters long and 1,200 meters wide at the widest) that of the Outer Alster. The fortifications as such were removed in 1815. The oldest portion of the city is that which lies to the east of the Alster; but, though it still retains the name of Altstadt, nearly all trace of its antiquity has disappeared, as it was rebuilt after the great fire of 1842. To the west lies the new town, incorporated in 1678; beyond this and contiguous to Altona is the quondam suburb of St. Paul's, incorporated in 1876, and toward the northeast is the quondam suburb of St. George, which arose in the thirteenth century, but was not incorporated till 1868. The old town lies low, and it is traversed by a great number of narrow canals or "fleets," which add considerably to the picturesqueness of the meaner quarters, and serve as convenient channels for the transport of goods. They generally form what may be called the back streets, and they are bordered by warehouses, cellars, and the lower class of dwelling-houses.

Of the churches actually existing in Hamburg (the old cathedral had to be taken down 1805), St. Peter's, St. Nicholas, St. Catharine's, St. James' and St. Michael's are those that give name to the five old city parishes. The church of St. Nicholas is remarkable more especially for its tower, which until the spire of Cologne cathedral reaches its projected elevation of 511 feet, will

probably continue to be the second highest cathedral in the world, rising as it does to a height of 473 feet, about nineteen feet lower than St. Ouen's at Rouen.

The oldest water-works of Hamburg were those of the Oberdamm, constructed in 1531; the first of the modern system, with steam power, was the Bieber'sche Elbwasserkunst, opened in 1822. In 1849 the city water-works belonging to the state were set in operation, and they have since incorporated and systematized the older water-works. In 1875 they had five steam engines with 850 horse power, and raised 876,000,000 cubic feet of water at a cost of about 16 cents per 1,000 cubic feet. It was not till after the fire of 1842 that Hamburg began to be properly drained; but it now possesses an extensive and elaborate system of sewers. In 1853 the upper Old Town, the New Town, and St. George's were supplied, and in 1859 the lower Old Town; and between 1871 and 1875 the system was extended to the aristocratic suburban districts of Uhlenhorst and Eimsbüttel. In 1875 the total length of sewers was 512,226 feet, which had cost £662,850. The largest sewers, of which there were 10,499 feet, have a diameter of nearly ten feet, and can be traversed by boats; the second class (8,330 feet) have a diameter of seven feet, and the third class (19,853 feet) of five and three-fifths feet.

The harbor of Hamburg, as it now exists, is a very modern creation. At first the city was at some distance from the main branch of the Elbe, and the mouth of the Alster served as its port, but partly owing to natural changes in the bed of the great river, and more to the vast engineering enterprises of the inhabitants,—such as the cutting of the channels through the Grandswerder (1550), the Spadenland marshes (1570), and the Brook,—the principal current was divided into its present course.

Hamburg is emphatically a commercial city, and though within recent years greatly developed, its manufacturing industries are in comparison unimportant; but only in comparison, for, according to the official return of 1875, no fewer than 4,931 persons were engaged in metallurgy, 5,926 in the manufacture of machinery, instruments, and tools, 940 in chemical works, 1,399 in the preparation of heating and lighting materials, 1,464 in textile industries, 2,687 in the paper and leather manufactures, and 9,388 in the wood industries. Shipbuilding is carried on extensively.

In the extent of its commerce Hamburg ranks among European ports immediately after London, Liverpool and Glasgow. Its imports and exports are more than those of the whole of Holland, of Belgium, or of Spain. The principal line of steamers is that of the Hamburg American Company. Its voyages are mainly made to New York and the West Indies.

The monetary transactions of Hamburg have long been maintained on a very extensive scale. As early as 1619 the great Hamburg giro-bank was founded on the model of that of Amsterdam, and, in spite of the blow struck by the French in 1813, it continued to flourish till in 1876 it was replaced by a chief office of the German Imperial Bank, which includes in its domain the province of Schleswig-Holstein-Lauenburg, the three Hanseatic towns, and the two grand-duchies of Mecklenburg.

The population in 1880 was 289,859, and is now (1890) estimated at 350,000.

The death rate varied from twenty-six to thirty per thousand per annum. Consumption and acute diseases of the respiratory organs are the most prevalent causes of death.

Hamburg, or, as the older documents have it, Hamaburg, appears to have taken its rise as a frontier block-house or castle on the Slavonic borders of Ger-

many, which in the nineteenth century lay thus far to the west. All through the tenth century Hamburg continued to suffer from the inroads of the Danes and the Slavonians, and the latter indeed were in possession from 983 to 987. The alliance with Lübeck, commenced in 1241, and consummated by the treaty of 1255, practically laid the basis of the great Hanseatic League, of which Hamburg continued to be one of the principal members. While its foreign relations were thus improved, its internal organization was also rendered more stable by the new constitution of 1270, and the recognition of the municipal autonomy of the counts of Schauenburg in 1292. The claims of the Danish crown to the homage of the city were rejected, and the imperial diet of 1510 under Maximilian I. declared that it was the city of the empire. Not long after two great changes took place. By the so-called "Long Recess" of 1529 the Reformation was introduced, and disagreements with Lübeck set the city free to follow her own path of progress. Through the troubles of the Thirty Years' War Hamburg escaped almost unscathed; but it suffered from the effects of its own bigoted Lutheranism, which drove many of its dissentient religionists forth to become the founders of the neighboring Altona. The course of the seventeenth century was marked by discord and strife between the senate and the lower classes, which ultimately brought about the interference of the empire and the publication of the *Great Recess* of 1712. Though the courts of the empire had decided in 1618 against the claims of the Danish crown, and had confirmed this decision in 1630 and 1643, Christian V. of Denmark made another attempt to take Hamburg by force of arms; but he accepted a ransom of 280,000 rixdollars, and at length in 1768 by the treaty of Gottorp the Danish crown renounced all its claims, and in 1770 the delegates of the city took their places in the "Rhenish bench" of the imperial diet. From the Seven Years' War and the war of American independence the commerce of Hamburg drew new life, but it suffered terribly during the years of the French ascendancy. The town was not only obliged in 1803 to pay 2,125,000 francs, to the Hanoverian estates, but in 1806 it had to admit a French garrison within its walls, and to feel the effects of the British blockade of the Elbe. In 1810 indeed it had the honor of being incorporated in the French empire as the chief town of the department of the "Mouths of the Elbe;" but the retreat of the French commandant Carra Saint Cyr on March 12, 1813, and the subsequent entrance of the Russian Tenterborn on the 18th, were welcomed by the citizens with joy. But their joy was premature, for by May 30th the enemy was again in possession. Davoust, the new general, not only demanded a contribution of 48,000,000 francs, but confiscated the 7,506,956 marks banco (of about 1s. 6d.) at that time in the bank, forced the inhabitants to work at the new fortifications, and drove 20,000 or 30,000 of them out of the city amid the cold of winter. In spite of the attacks of the Russians under Benningsen, Davoust maintained his position till the close of the war. The whole loss of the city from 1806 to 1814 is estimated at £10,500,000 sterling. In 1815 Hamburg became an independent state of the German federation, and formed, with Lübeck, Bremen, and Frankfort, the curia of the free cities. Its trade rapidly revived, and when in 1842 the great fire destroyed 4,219 buildings and rendered nearly 20,000 persons homeless, its credit was sufficient to secure a loan of thirty-four million marks banco. The old oligarchical constitution had been restored after the recovery of independence; and the internal history of the town from 1840 till 1860 is mainly a protracted contest between the conservative and innovative parties. The year 1858 was remarkable

for a great commercial crisis, and for the meeting in the town of the commission of the navigation of the Elbe, and of the delegates appointed by the principal German states to consider maritime law. By the new constitution of 1861 industrial freedom was introduced, possession of land permitted to strangers, the conditions of settlement greatly modified, and various improvements made in the taxation and duties. At the outbreak of the contest between Prussia and Austria in 1866, Hamburg sided with the former, and in May, 1867, it voted for the constitution of the North German Confederation.

On October 1, 1888, Hamburg entered the German Custom Union, though still retaining part of its territory as a "free port." This change has necessitated extensive alterations in the harbor; several quays have been built, warehouses constructed, steam-cranes erected, and the railway communication with the chief industrial centers of Germany improved.

HAMELN, the chief town of a circle in the province of Hanover, Prussia, is situated at the confluence of the Weser and Hamel, and at the junction of four railways, twenty-five miles southwest of Hanover. Population (1890), 10,000.

Hamel is famed as the scene of the myth of the piper of Hameln. According to the legend, the town in the year 1284 was so infested by rats as almost to compel the inhabitants to leave it, when one day there appeared upon the scene a piper, clad in a fantastic suit, who offered, for a certain sum of money, to charm all the vermin into the Weser by his piping. His conditions were agreed to, but after he had fulfilled his promise, the inhabitants, on the ground that he was a sorcerer, declined to fulfill their part of the bargain, whereupon, on June 26, he reappeared on the streets of the town, and putting his pipe to his lips began a soft and curious strain, which drew all the children to come trooping after him, while he led them out of the town to the Koppelberg hill, in whose side a door suddenly opened, by which he entered and the children after him, all but one, who was lame, and could not follow fast enough to reach the door before it shut again, and remained fast.

HAMI, the Chinese name of a town in Central Asia, otherwise called KAMIL, KOMUL, or KAMUL, situated on the southern slopes of the Tian-Shan mountains, and on the northern verge of the Great Gobi desert.

HAMILCAR BARCA, the most illustrious of all the Carthaginian generals and statesmen, next to his son, the great Hannibal. The surname Barca is the same as the Hebrew *Barak*, and signifies "lightning." It was in the eighteenth year of the First Punic War, 247 B.C., that Hamilcar first greatly distinguished himself. He had been known before as a young officer of promise who had made raids on the southern coasts of Italy in the neighborhood of Locri and Cumæ. Suddenly he appeared with a squadron off the northwest of Sicily, and seized a strong position on Mount Ercte, now known as Mount Pellegrino, near Palermo. He had but a small force of mercenaries, which his military genius soon made into a well-disciplined body of troops. For three years he maintained himself on Mount Ercte, during which time the Romans were in possession of the whole of Sicily with the exception of the two strongholds of Drepanum and Lilybæum, and these they were blockading. The Romans, feeling it necessary to make a supreme effort, in 242 B.C. equipped a fleet, under the command of the consul Lutatius Catulus, and dispatched it to the western shores of Sicily. The battle off the Ægates followed, and the Roman victory decided the First Punic War in 241 B.C.

No sooner had peace been concluded than there broke out the so-called African or Libyan War. It

was a most formidable mutiny or insurrection. The peace party at Carthage, headed by Hanno, who hated Hamilcar, was foolish enough to raise a dispute about the pay of the troops. The result was a furious mutiny, which Hanno, who was sent to quiet them, could not appease. The men to the number of 20,000 began to march on Carthage itself, and encamped near Tunis. But they were soon surrounded and cut off to a man. The war, which had lasted three years and four months, was over in the year 238 B.C.

Hamilcar was made commander-in-chief of the Carthaginian army in Africa, and invested with a power which could be taken from him only by the popular assembly. He was still a young man, under thirty years of age. For a short time he employed himself in overawing the Numidian tribes bordering on Carthaginian territory, but his main object was to form the nucleus of an efficient army out of his Libyan mercenaries. Meanwhile he was maturing a great plan which soon afterward on his own responsibility he carried into execution. Spain was a country the coasts of which at least were well known to the Carthaginians. Spaniards too had served among Hamilcar's troops. To Spain he decided to go; there, he felt sure, he could find material for an army and abundant means of providing pay. He had now three sons, the "lion's brood," as he called them, Hannibal, Hasdrubal, Mago. Wishing with all his heart that they should be like minded with himself, he made the eldest, Hannibal, then a boy of nine, swear on the altar of the supreme Carthaginian deity eternal hatred and enmity to Rome. This was just before he left Carthage, probably in the spring of 236 B.C. He never returned. The last eight years of his life he devoted to the great work of reducing Spain to a Carthaginian province. Had his life been prolonged, he would doubtless, as Livy says, have invaded Italy at the head of a Carthaginian army. What he accomplished in Spain so much impressed the elder Cato, who less than half a century afterward saw the traces of his work, that he declared that there was no king like Hamilcar Barca. In the prime of his years he fell in battle in 228 B.C., fighting, it would seem, somewhere between the Tagus and the Douro. Spain was now left in the hands of his son-in-law Hasdrubal.

HAMILTON, a municipal and parliamentary borough and market-town of Scotland, county of Lanark. Among the industries of the town are weaving and the tambouring of muslin; and there are also large market gardens; but the prosperity of the town depends chiefly upon the coal and iron-stone which are extensively worked in the neighborhood. Hamilton originated in the fifteenth century under the protecting influence of the lords of Hamilton. It unites with Airdrie, Falkirk, Lanark, and Linlithgow to form the Falkirk district of boroughs, which returns one member to parliament. Population, 13,000.

HAMILTON, a Canadian city, in the county of Wentworth, Province of Ontario, lies at the western end of Lake Ontario, about seventy-five miles northwest from Buffalo, N. Y. Its site is the footlands of the base of a series of hills, the name "mountain" being appended to the elevation contiguous to the city. The first settlement in the city was made in 1778 by a Pennsylvania Tory named Robert Land, who emigrated from Pennsylvania on account of the hostilities then in progress between England and the colonies. Soon afterward he was joined by his wife and two sons and commenced farming on a tract of land which is now in the heart of the city. From this time till 1813 the little community grew slowly. In that year George Hamilton, a far-seeing member of the parliament, laid out the town site which has since been the nucleus around

which the present city has grown. During the war of 1812 Hamilton was regarded as a strategic point of value by both the Americans and the Canadians, and there still are to be seen traces of the old earthworks by which the city was fortified. The battle of Stony Creek, however, prevented the city from actually being the scene of conflict, as the Federal troops were routed here and the invasion was practically ended. From 1814, at which time the first general merchandise store was established in the town, the growth of the place was more perceptible, and when in 1824 the Hamilton canal was chartered (finished eight years later) a rapid growth was immediately resultant. By its great natural advantages, and its convenience of situation for commercial traffic by way of the great lakes, a large number of immigrants were attracted, and the town was soon in the enjoyment of what we in this day call a "boom." By 1858 the population had reached the number of nearly 22,000. Ten years before it was only 7,000. This remarkable increase of population was in part due to the construction of various works, and the prosecution of private corporate enterprises, the most notable among which were the Hamilton waterworks and the Great Western and Hamilton & Port Dover railways. The town had some severe set-backs, however, in the form of fire, epidemic cholera, and last, but not least, the financial crisis of 1859, the effect of which was so disastrous that it is said for several years every energy of the people was paralyzed—not a building being erected in all that time. The present city of Hamilton is a very pretty place, the streets being mostly regular and well laid out at right angles. The buildings are handsome, and the people are supplied with all the most approved modern conveniences of urban life. The water supply is obtained from Lake Ontario, the average daily consumption last year (1889) being nearly three and one half million gallons. The amount of capital invested in manufactures is about \$8,000,000, employing 12,290 persons, paying wages yearly of \$3,800,000, and producing articles worth \$10,000,000 from raw material worth \$6,000,000. The principal manufactures are iron, machinery, agricultural implements, wooden and glassware, musical instruments, woolen and cotton goods, boots and shoes, soap, candles, etc. The shipping interests are principally represented by coal and lumber, but of late years the lumber trade has decreased.

The police department of the city government is well conducted by an efficient force of fifty men. The public schools of the city are composed of 143 rooms (or schools) with 139 teachers and 6,375 pupils. The fire department consists of thirty-four men, one steamer, one chemical engine, three hose companies, two hook and ladder companies, and one Merriweather fire escape. All the appliances and machinery of the department are of the most approved and modern style, and the discipline and efficiency of the department are very high. The religious portion of the community is well provided with churches, the principal denominations being all represented, having churches with ample sittings and vigorous organizations. There are several military volunteer organizations in the city, all in a high state of efficiency and supplied with the best modern equipment. The board of trade is an active, enterprising feature of the community and the reports of business for the year 1889 gives ample assurance of the solid prosperity of the city. Hamilton is the seat of the Anglican bishop of western Ontario and of the Catholic bishop of Hamilton. There are numerous parks and places of resort in the city and the contiguous country, and in the summers the number of pleasure-seekers at various points of interest is always large. The population of the city in 1890 was 44,653.

HAMILTON, a township and post village of Madison county, N. Y. The village is the seat of Madison university, chartered in 1846, in connection with which there are a theological seminary of the Baptist denomination opened in 1820, and a preparatory academy opened in 1832 under the name of Colgate Academy, and chartered in 1853 as the grammar school of the university. The university has ten professors, has both a scientific and a classical course, and is attended by upward of 100 students. The other educational institutions are a female seminary and a union graded school. Population (1890), 2,000.

HAMILTON, a city of Ohio, the county seat of Butler county, is a place of (1890 census) 17,565 inhabitants. It lies on the Miami river about twenty-five miles north of Cincinnati. The city has important manufactories, consisting of flouring mills, iron foundries, agricultural implement factories, breweries, etc. It has banking, railroad and telegraph facilities, together with ample educational and church accommodations. The city has had a steady growth, both in population and commercial importance.

HAMILTON, the principal town in the western district of Victoria, Australia, is situated on the Grange Burne Creek. It was proclaimed a borough in 1859, the area of the municipality being 5,280 acres. Population, 12,000.

HAMILTON, ALEXANDER, born in the Island of Nevis, West Indies, January 11, 1757; died in New York city July 12, 1804. He was the son of a Scotch merchant, and at an early age entered a business office in Saint Croix. In 1772 he came to America and studied at King's (now Columbia) college in New York city. When only seventeen years old he made a public speech in favor of the assertion of liberty by the colonists, and published several pamphlets which attracted much attention. Early in 1776 he became captain of an artillery company, which distinguished itself in the battles of Long Island and White Plains. The military talents and literary ability of young Hamilton attracted the attention of General Washington, who, in March, 1777, appointed him aide-de-camp with the rank of lieutenant-colonel. He fought at Monmouth and succeeded in persuading General Gates to furnish reinforcements to Washington after the surrender of Burgoyne. In 1781 he resigned from the staff in consequence of a disagreement with Washington, but retained his army rank and distinguished himself at Yorktown. On December 14, 1780, he married Elizabeth Schuyler, a member of a wealthy New York family. He studied law and became receiver of taxes in New York, and in November, 1782, took his seat as a member of the Continental congress, having been elected by the legislature of New York. He resigned the following year, and began the practice of law in New York city, where he speedily rose to the first rank in his profession. His fine personal appearance, magnificent voice, and suave manner, combined with his thorough study of law made him preëminent in the courts. In 1786 he was elected to the State legislature.

But Hamilton's greatest work was to come. The government of the Confederation had shown its impotence and inadequacy, and the country was suffering from the evils of a prostrate trade and a bankrupt treasury. It was evident that a permanent union of the States must be effected, and in the movement for this end Hamilton was the principal actor. He was elected to the Philadelphia convention of 1787, at which the constitution of the United States was adopted. In this body he was in a hopeless minority, but he presented his views in an able speech, and, although he withdrew

from the convention temporarily, he affixed his name to the constitution, and advocated its adoption. Hamilton was a Federalist of the extreme type. He had also inherited or acquired ideas as to the system of government, based on the ancient and aristocratic methods. The plan he proposed contemplated the election of a president and senators for life, and the nomination of State governors by the national executive. But when outvoted he accepted the results of the convention's deliberations, and in a series of powerful articles in the famous *Federalist*, recommended the ratification of the constitution. In the New York ratifying convention, Hamilton, by his eloquence and parliamentary skill, succeeded in converting the hostile majority, and at the popular election the Federalists triumphed.

Washington was inaugurated first president of the United States in April, 1789, and in September called Hamilton to the head of the newly-organized treasury department. The finances of the country were in a deplorable condition. The nation was burdened with a heavy debt, and its credit abroad was of the worst. But in a masterly document, one of the most statesmanlike papers ever prepared, Hamilton, in January, 1790, presented to congress a "Report on the Public Credit," containing a plan of financial policy by the adoption of which order was brought out of chaos. He provided for a system of funding the debt and for raising funds by taxation, by which credit was restored and the business world relieved. He favored a protective tariff for the encouragement of home manufactures, and prepared plans for a mint, for the regulation of the currency, for an excise, for the management of the post office and the public lands, and for the gradual extinction of the national debt.

The Republican party, of which Jefferson and Burr were the most prominent exponents, fought Hamilton's policy in congress and the newspapers. Hamilton advocated a strict neutrality in foreign affairs and declined to give any assistance to France, then struggling for life against the allied despotism of Europe. Jefferson, having failed to obtain the retirement of Hamilton from the cabinet, resigned himself in January, 1794. A year later Hamilton returned to his law practice, and declined the position of chief justice of the United States Supreme Court. In 1796 he supported John Adams for the presidency, and was appointed inspector-general of the army, which post he held for two years, with the rank of major-general. On Washington's death in December, 1799, he became commander-in-chief of the army, but this was shortly after disbanded, and he again returned to his law practice. Meantime the differences between Adams and Hamilton had widened and the election of 1800 was at hand. Hamilton made a bitter personal attack on Adams over his negotiations with France, and the Federalists were beaten at the polls. But Burr and Jefferson had each received an equal number of electoral votes and the choice of president devolved on the House of Representatives. The influence of Hamilton was given to Jefferson and the latter was elected. Burr neither forgot nor forgave this, nor his defeat later for the governorship of New York, in which Hamilton openly opposed him. An excuse was found for a quarrel in the language publicly used by Hamilton with reference to Burr, and the latter sent him a challenge. They met at Weehawken, on the banks of the Hudson, on the morning of July 11, 1804, and Hamilton fell mortally wounded at the first fire, dying on the following day. Burr absconded to South Carolina, not daring to face the storm of popular indignation which arose, but soon appeared in Washington and resumed his functions as vice-president. The duel was forced upon Hamilton,

and although Burr was indicted for murder, the prosecution came to nought, and he was never punished.

HAMILTON, ANTHONY or ANTOINE (1646-1720), a French classical author, who is especially noteworthy from the fact that, though by birth he was a foreigner, his literary characteristics are more decidedly French than those of many of the most indubitable Frenchmen. It is mainly, as has already been indicated, by the *Mémoires du Comte de Grammont* that Hamilton takes rank with the most classical writers of France. The work was first published anonymously in 1713 under the rubric of Cologne, but it was really printed in Holland, at that time the great patroness of all questionable authors. An English translation by Boyer appeared in 1714. Upward of thirty editions have since appeared.

HAMILTON, ELIZABETH, novelist and miscellaneous writer, was born at Belfast, of Scotch extraction, July 25, 1758. In her fifteenth year she made a tour in the Highlands with some friends, and wrote a journal which was inserted in a provincial magazine. She produced her *Letters of a Hindoo Rajah* in 1796, and in 1800 the *Memoirs of Modern Philosophers*, a satire on the admirers of the French revolution. In 1801-2 the *Letters on Education* appeared, her most valuable though not her most popular work. She died in July, 1816.

HAMILTON, JAMES (1769-1831), the author of the Hamiltonian system of teaching languages, was born in 1769 and died October 31, 1831. Having settled in Hamburg and become free of the city, he was anxious to become acquainted with German and accepted the tuition of a French emigré, General D'Angelis. In twelve lessons he found himself able to read an easy German book, his master having discarded the use of a grammar and translated to him short stories word for word into French. He came in 1814 to America, intending to become a farmer and manufacturer of potash; but, changing his plan he started as a teacher in New York. Adopting his old tutor's method, he attained remarkable success in New York, Baltimore, Washington, Boston, Montreal, and Quebec. Returning to England in July, 1823, he was equally fortunate in Manchester and elsewhere. His system attracted general attention, and was vigorously attacked and defended.

HAMILTON, PATRICK, son of Sir Patrick Hamilton, well known in Scottish chivalry, and of Catherine Stewart, daughter of Alexander, duke of Albany, second son of James II. of Scotland, was born in the diocese of Glasgow. Of his early boyhood and education nothing is known. In 1517 he was appointed titular abbot of Ferne, Ross-shire; and probably about the same year went to study at Paris. Returning to Scotland, the young scholar naturally selected St. Andrews, the capital of the church and of learning, as his residence. On June 9, 1523, he became a member of the university of St. Andrews, and was admitted to its faculty of arts. There Hamilton attained such influence that he was permitted to conduct in the cathedral a musical mass of his own composition. But the reformed doctrines had now obtained a firm hold on the young abbot, and he was eager to communicate them to his fellow-countrymen. Early in 1527 the archbishop Beatoun's attention was directed to the heretical preaching of the young priest, whereupon he ordered that Hamilton should be formally summoned and accused. Hamilton fled to Germany, first visiting Luther at Wittenberg, and afterward enrolling himself as a student, under Francis Lambert of Avignon, in the new university of Marburg, opened May 30, 1527, by Philip, landgrave of Hesse. Late in the autumn of 1527 Hamilton returned to Scotland. He went first to his brother's house at Kinçavel, near

Linlithgow, in which town he preached frequently. Beatoun, avoiding open violence through fear of Hamilton's high connections, invited him to a conference at St. Andrews. The reformer accepted the invitation, and for nearly a month was permitted to preach freely. At length, however, he was summoned before a council of bishops and clergy presided over by the archbishop; and though he clearly and calmly answered all the written charges brought against him, his replies gave ground for new accusations of heresy. The council eagerly convicted him, and handed him over to the secular power. The sentence was carried out on the same day (February 29, 1528) lest he should be rescued by his friends, and he was burned at the stake as a heretic.

HAMILTON, ROBERT (1743-1829), an able writer on political economy and finance, was born at Pilrig, Edinburgh. In 1779 he was presented to the chair of natural philosophy at Aberdeen university. For many years, however, by private arrangement with his colleague Professor Copland, Hamilton taught the class of mathematics. In 1817 he was presented to the latter chair. For some years before his death in July, 1829, he had retired from the active business of his chair.

Hamilton's most important work is the *Essay on the National Debt*, which appeared in 1813, and was undoubtedly the first to expose the economic fallacies involved in Pitt's policy of a sinking fund.

HAMILTON, THOMAS, author of *Cyril Thornton*, was the younger brother of Professor Sir William Hamilton, Bart., and was born in 1789. He was a frequent contributor to *Blackwood's Magazine* from its commencement, his papers manifesting great variety and versatility of talent, and embracing both prose and poetry. The most popular of his contributions to that periodical was the military novel *Cyril Thornton*. He died at Pisa, 1842.

HAMILTON, SIR WILLIAM, BART., one of the most eminent of Scottish metaphysicians, was born in Glasgow on March 8, 1788. William received his early education in Scotland, except during two years which he spent in a private school near London, and went in 1807, as a Snell exhibitor, to Balliol College, Oxford. There he pursued his studies zealously, though for the most part independently,—devoting himself chiefly to Aristotle, but in other directions also laying the foundations of that wide and profound scholarship with which his name is associated. In November, 1810, he took the degree of B.A. with first-class honors, after an examination so much above the usual standard in the number and difficulty of the works which it embraced that the memory of it was long preserved at Oxford. He had been intended for the medical profession, but, soon after leaving Oxford, gave up this idea, and in 1813 became a member of the Scottish bar. Henceforward Edinburgh was his place of residence, and, except on occasion of two short visits to Germany in 1817 and 1821, he never again quitted Scotland. His life was mainly that of a student; and the following years, marked by little or outward incident, were filled by researches of all kinds, through which he daily added to his stores of learning, while at the same time he was gradually forming his philosophic system.

In 1820 he was an unsuccessful candidate for the chair of moral philosophy in the university of Edinburgh. Soon afterward he was appointed professor of civil history, and as such delivered several courses of lectures on the history of modern Europe and the history of literature. In 1829 his career of authorship began with the appearance of the well known essay on the *Philosophy of the Unconditional*—the first of a series of articles contributed by him to the *Edinburgh Review*. He was elected in 1836 to the Edinburgh chair of logic and

metaphysics, and from this time dates the influence which, during the next twenty years, he exerted over the thought of the younger generation in Scotland. In 1852-53 appeared the first and second editions of his *Discussions in Philosophy, Literature and Education*, a reprint, with large additions, of his contributions to the *Edinburgh Review*. Soon after his general health began to fail. Still, however, aided now as ever by his courageous and devoted wife (he had married in 1829), he persevered in literary labor; and during 1854-55 he brought out nine volumes of a new edition of Stewart's works. The only remaining volume was to have contained a memoir of Mr. Stewart from his pen; but this he did not live to write. He taught his class for the last time in the winter of 1855-56. Shortly after the close of the session he was taken ill, and on May 6, 1856, he died at his house in Edinburgh.

HAMILTON, SIR WILLIAM (1730-1803), antiquary and patron of the fine arts, was born in 1730. Of his early life and education we know nothing beyond the fact that he was equerry to Prince George; but in his twenty-fifth year he married a young and beautiful heiress, whose fortune placed him in affluence. In the first parliament of George III. Hamilton sat as member for Midhurst; and in 1764 he was accredited ambassador to Naples, an office which he retained till 1800. On proceeding to his post his attention and interest were at once awakened by the discoveries at Pompeii and Herculaneum, and he took up the studies of antiquities with ardor. The Porcinari collection of Greek and Etruscan vases, purchased in 1765, was the nucleus of a valuable collection of his own, now for the most part in the British Museum. Hamilton also contributed liberally to the museum at Portici, and gave much attention to the MSS. and other valuable articles rescued from the buried cities; but his efforts were almost nullified by the inertness of the Neapolitan court, which was even suspicious of his zeal. Natural history and science also were not neglected by him. Hamilton's daughter died in 1775, and his first wife in 1782. In 1772 he was made K.C.B., and in 1791 privy councilor. His continued interest in art and antiquity is manifested by his contributions to the *Philosophical Transactions* of the Royal Society from 1767 to 1795, and to the *Archæologia* in 1777, as well as by his generosity to artists and antiquaries, such as Morghen, Winckelmann, and Piaggi. Recalled in 1800, he died April 6, 1803. Sir William Hamilton's second wife, Emma Lyon or Harte, whose name is so notoriously associated with that of Nelson, was born of very humble parents at Preston, in Lancashire, about April 26, 1764. Her youth was spent in domestic service, and it was first as attendant on a lady of fashion that she learned to develop her talent for singing and mimicry. Having lost this situation she became waitress in a tavern frequented by actors, and soon entered upon a gay and dissolute career. Her beauty attracted, among others, the painter Romney, who depicted her in no fewer than twenty-three of his works. Sir William Hamilton married her in 1791; and, going with him the same year to Naples, she speedily acquired an ascendancy over the mind of the queen, which, at the instigation of Nelson, she used for the advantage of the British fleet. On the death of Sir William she lived in a house at Merton Place, provided for her by Nelson, but on his death in 1805 she soon squandered the modest fortune left her by her husband, and after being imprisoned for debt, retired with Nelson's daughter, Horatia, to Calais, where she died January 16, 1815. Her *Memoirs* appeared in the year of her death.

HAMILTON, WILLIAM, a minor Scottish poet, the author of *The Braes of Yarrow*, was born in 1704, at

Bangour, in Linlithgowshire. He died at Lyons, March 25, 1754.

HAMILTON, SIR WILLIAM ROWAN, one of the really great mathematicians of the present century, was born in Dublin, August 4, 1805.

His genius displayed itself, even in his infancy, at first in the form of a wonderful power of acquiring languages. At the age of seven he had already made very considerable progress in Hebrew, and before he was thirteen he had acquired, under the care of his uncle, who was an extraordinary linguist, almost as many languages as he had years of age. Among these, besides the classical and the modern European languages, were included Persian; Arabic, Hindustani, Sanskrit, and even Malay. But though to the very end of his life he retained much of the singular learning of his childhood and youth, often reading Persian and Arabic in the intervals of sterner pursuits, he had long abandoned them as a study, and employed them merely as a relaxation.

His mathematical studies seem to have been undertaken and carried to their full development without any assistance whatever, and the result is that his writings belong to no particular "school," unless indeed we consider them to form, as they are well entitled to do, a school by themselves. As an arithmetical calculator he was not only wonderfully expert, but he seems to have occasionally found a positive delight in working out to an enormous number of places of decimals the result of some irksome calculation. At the age of twelve he engaged Colburn, the American "calculating boy," who was then being exhibited as a curiosity in Dublin, and he had not always the worst of the encounter. But, two years before, he had accidentally fallen in with a Latin copy of *Euclid*, which he eagerly devoured; and at twelve he attacked Newton's *Arithmetica Universalis*. This was his introduction to modern analysis. He soon commenced to read the *Principia*, and at sixteen he had mastered a great part of that work, besides some more modern works on analytical geometry and the differential calculus.

About this period he was also engaged in preparation for entrance at Trinity College, Dublin, and had therefore to devote a portion of his time to classics. In the summer of 1822, in his seventeenth year, he began a systematic study of Laplace's *Mécanique Céleste*. Nothing could be better fitted to call forth such mathematical powers as those of Hamilton; for Laplace's great work, rich to profusion in analytical processes alike novel and powerful, demands from the most gifted student careful and often laborious study.

Having detected an important defect in one of Laplace's demonstrations, he was induced by a friend to write out his remarks, that they might be shown to Doctor Brinkley, afterward bishop of Cloyne, but who was then royal astronomer for Ireland, and an accomplished mathematician. Brinkley seems at once to have perceived the vast talents of young Hamilton, and to have encouraged him in the kindest manner. He is said to have remarked in 1823 of this lad of eighteen, — "This young man, I do not say *will be* but *is*, the first mathematician of his age."

Hamilton's career at college was perhaps unexampled. Among a number of competitors of more than ordinary merit, he was first in every subject, and at every examination. His appointment to the Andrews professorship of astronomy in the university of Dublin, vacated by Doctor Brinkley, took place in 1827. Thus, when barely twenty-two, he was established at the Dublin Observatory. He was not specially fitted for the post, for although he had a profound acquaintance with theoretical astronomy, he had paid but little attention to the regular work of the practical astronomer.

In 1835, being secretary to the meeting of the British Association which was held that year in Dublin, he was knighted by the lord-lieutenant. But far higher honors rapidly succeeded, among which were his election in 1837 to the president's chair in the Royal Irish Academy, and the rare and coveted distinction of being made corresponding member of the academy of St. Petersburg. These are the few salient points (other, of course, than the epochs of his more important discoveries and inventions) in the uneventful life of this great man. He retained his wonderful faculties unimpaired to the very last, and steadily continued till within a day or two of his death (September 2, 1865) the task (his *Elements of Quaternions*) which had occupied the last six years of his life.

The germ of his first great discovery was contained in one of those early papers which in 1823 he communicated to Doctor Brinkley, by whom, under the title of *Causitics*, it was presented in 1824 to the Royal Irish Academy. It was referred as usual to a committee. Their report, while acknowledging the novelty and value of its contents, and the great mathematical skill of its author, recommended that, before being published, it should be still further developed and simplified. During the next three years the paper grew to an immense bulk, principally by the additional details which had been inserted at the desire of the committee. But it also assumed a much more intelligible form, and the grand features of the new method were now easily to be seen. Hamilton himself seems not till this period to have fully understood either the nature or importance of his discovery, for it is only now that we find him announcing his intention of applying his method to dynamics. The paper was finally entitled *Theory of Systems of Rays*, and the first part was printed in 1828 in the *Transactions of the Royal Irish Academy*.

The step from optics to dynamics in the application of the method of "Varying Action" was made in 1827, and communicated to the Royal Society, in whose *Philosophical Transactions* for 1835 and 1834 there are two papers on the subject. These display, like the "Systems of Rays," a mastery over symbols and a flow of mathematical language almost unequalled.

The other great contribution made by Hamilton to mathematical science, the invention of QUATERNIONS, is fully treated under that heading. It is not necessary to say here more than this, that quaternions form as great an advance relatively to the Cartesian methods as the latter, when first propounded, formed relatively to Euclidian geometry.

HAMÍRPUR, or HUMEERPOOR, a British district in the lieutenant-governorship of the Northwestern Provinces, India, forms the southwestern district of the Allahábád division, and incloses the native states of Saríla, Jigní and Bíhat, besides portions of Charkhári and Garrauli.

Hamírpur forms part of the great plain of Bundelkhand, which stretches between the banks of the Jumna and the central Vindhyan plateau. The district is in shape an irregular parallelogram, with a general slope northward from the low hills on the southern boundary. The scenery is rendered picturesque by the artificial lakes of Mahoba. These magnificent reservoirs were constructed by the Chandel rájás about 800 years ago, for purposes of irrigation and as sheets of ornamental water. Many of them inclose craggy islets or peninsulas, crowned by the ruins of granite temples, exquisitely carved and decorated. From the base of this hill and lake country the general plain of the district spreads northward in an arid and treeless level toward the broken banks of the rivers. Of these the principal are the Betwa and its tributary the Dhasán, both of which are

unnavigable. There is little waste land, except in the ravines by the river sides. The deep black soil of Bundelkhand, known as *már*, retains the moisture under a dried and rifted surface, and renders the district fertile. The last census gives a population of 529,137 — 276,196 males and 252,941 females. The Hindus numbered 493,877, and the Mahometans 33,658. The district contains six towns with a population of more than 5,000 souls, namely, Ráth, Hamírpur, Mahoba, Maudha, Sumerpur, and Jáitpur. The staple produce of the district is grain of various sorts, the most important being gram. Cotton is also a valuable crop, whose cultivation is on the increase. Out of a total area of 1,464,641 acres, 762,212 are under cultivation.

HAMÍRPUR, the administrative headquarters of the above district, is situated on a tongue of land at the confluence of the Betwa and the Jumna, on the right bank of the latter river. Population, 8,000.

HAMLET, the hero of Shakespeare's drama, is, according to some interpreters, an historical or quasi-historical personage, but according to others his story is a mere development or "precipitation" of the great Scandinavian system of mythology. The decision of this point is rendered all the more difficult as the only original authority for the facts (historical or mythological) is the Danish historian Saxo Grammaticus (d. 1204). Though Doctor Vigfusson (prolegomena to the *Sturlunga Saga*, Oxford, 1878) concludes that the Hamlet legend was contained in the Skjöldunga Saga now lost, it is of course matter of question whether Saxo based this portion of his narrative on previous writings or collected his material from oral traditions.

According to Saxo, Hamlet's history is briefly as follows: In the days of Rörik, king of Denmark, Gervendill was governor of Jutland, and in this office he was succeeded by his sons Horvendill and Fengo. The former, returning with glory from a viking expedition in which he had defeated Koller, king of Norway, obtained the hand of Gerutha, Rörik's daughter, who in due course bore him a son, Amleth. But Fengo, out of jealousy, murdered Horvendill with his own hand, and then persuaded Gerutha to become his wife, on the plea that he had committed the crime for no other reason than to avenge her of a husband by whom she had been hated. Amleth, afraid of sharing his father's fate, pretends to be imbecile, but the suspicion of Fengo puts him to various tests, which are related with all the inconsequent simplicity of the ordinary *Märchen*. Dispatched to England in company with two attendants, who bear a letter instructing the king of that country to put him to death, he surmises the purport of their instructions, and secretly modifies the inscription on their "tablets" so that the king is requested to put them to death and to treat him with honor. By his wisdom he makes a deep impression on the king, and obtains the hand of the royal princess; but, instead of settling in England, he returns at the end of a year to Denmark, where he is supposed to be dead, just as the people are celebrating his obsequies. During the feast that follows he makes the courtiers all drink freely, and then, when they are heavy with wine and sleep, he pulls down over them the hangings of the hall, fixes these with pegs which he had sharpened and prepared in the early stage of his folly, and then setting fire to the building leaves the revelers to their fate. He next proceeds to the royal chamber to take vengeance on Fengo himself, who falls beneath the stroke of his own sword, for which Hamlet had substituted his own scabbard-fastened weapon. Returning to England for his wife, the hero finds that his father-in-law and Fengo had been under pledge to each other that the survivor should avenge the other's death if it resulted from violence; and his father-in-law, unwilling to make a

direct attack on his life, sends him to Scotland as proxy-suit for the hand of a terrible queen Hermuthruda, who has put all previous wooers to death. But Hermuthruda happens to fall in love with Hamlet, and he returns to England to upbraid his father-in-law with his treachery. As king of Jutland he has to endure the grievous hostility of Vikletus, Rörik's successor, but at last determines, though well aware that he is doomed to death in the attempt, to engage with him in a decisive battle. He perishes, and his widow marries Vikletus.

According to Latham, who may be taken as the representative of the historical theory, there are really two Hamlets—the Hamlet of Saxo's third book and the Hamlet of his fourth book, who have been confounded together. The former, who is the Shakespearean hero, he would identify with Olaf Kyrre; the Anlaf Cwiran of the Saxon Chronicle and the Amlaf Cuaran of the Irish Annals, whose name, having passed through England and Ireland, he supposes to have returned to Denmark in a form which is Latinized by Saxo as Amlethus; the latter he considers as the Hygelac of Beowulf, the Chochilaicus of Gregory of Tours, the Huhleike of the Heimskringla, and even the Havelock of English legend.

That, in spite of the links by which Saxo has sought to connect its different portions with the authentic history of Denmark, the whole story was destitute of historical basis was maintained by P. E. Müller, and his conclusions in regard to the matter have been very generally accepted.

HAMM, a town of Prussia, capital of a circle in the government district of Arnsberg, province of Westphalia, is situated at the junction of several railways, on the Lippe at its confluence with the Ahse, twenty-two miles northwest of Arnsberg. Pop. (1890), 20,000.

HAMMARSKÖLD, LORENZO (1785–1827), Swedish author, was born at Tuna, near Wimmerby. In 1818 appeared the first part of Hammarsköld's chief contribution to literature, his famous *Svenska Vitterheten*, a history of polite letters in Sweden, a book that was revised and republished after his death by Sondén, in 1833.

HAMME, a town of Belgium, in the province of East Flanders and the arrondissement of Termonde or Dendermonde, is situated on the right bank of the Durme, near its junction with the Scheldt, and eighteen miles east-northeast of Ghent. Pop. (1880), 12,000.

HAMMER. This well-known tool stands quite without rival for producing the numberless effects which are due to the remarkable force of "impact." Of all the array of hand tools in use in the industrial arts it is undoubtedly the one that could least be dispensed with, and so it must have been from the very earliest days of handicraft. A hammer of some rude kind must have been as essential to the shaping of an arrow-head out of a flint, as is its modern representative to the forging of a bayonet out of a bar of steel.

Hammers to be used by hand are made of an endless variety of shapes, and of weights varying from a small fraction of an ounce to twenty-eight or thirty pounds. Of the various types now in use the differences are mainly due to the special requirements of the particular trades for which they are intended, but partly also to individual fancy.

Hand-hammers and sledge-hammers being rigidly limited as to weight by the trifling power which one man—or at most two men—can bring to bear upon them, it long ago became obviously desirable to obtain the force of impact from some more powerful source than human muscles, so that the weight of hammer heads might be largely increased and their blows made proportionately more effective. The first step taken in this direction seems to have been the introduction of

the "Hercules," a ponderous mass of iron attached to a vertical guide rod, which was lifted originally by a gang of men with ropes, but afterward by steam power, and allowed to fall by its own weight. This was a fairly efficient tool for forging large anchors, and for similar purposes, the strength of the blow and the point at which it was delivered being easily regulated. But as the demand for wrought iron increased, the necessity for more rapid as well as more powerful hammers to aid in its manufacture increased also. The lift or helve hammer and the tilt hammer thus came into use, and under these forms hammers may be said to have ranked for the first time as true machine tools. Each of these consists of a heavy head attached to a beam mounted on gudgeons, which is lifted at regular intervals by suitable cams or pins carried by a revolving shaft driven by steam or other power, their chief points of difference being the relative position of the gudgeons and the portion of the beam at which the power is applied.

In the steam hammer which was first patented by Nasmyth in the year 1842, the inventor, produced a machine capable of being made to deliver its blows with a force to which no limit has yet been found, and yet so perfectly under control as to be able to crack a nut without injuring the kernel. To the introduction of this invaluable tool is due more than to any other single cause the power which we now possess of producing the forgings in iron and steel which are demanded by the arts of modern times; and in one or other of its many forms it is now to be met with in every workshop in which heavy work is carried on. Many modifications of the Nasmyth steam hammer have been introduced.

Duplex hammers differ materially from the ordinary steam hammer, inasmuch as no anvil is necessary,—two hammer heads of equal weight (and for some purpose they weigh only a few pounds, for others as much as thirty tons) being made to deliver horizontal blows of equal force simultaneously on opposite sides of the forging, which thus receive perfectly equal treatment. The importance of this may be gathered from the fact that every increase in the weight of the vertical steam hammer necessitates a very much larger increase in the weight and solidity of the anvil which is necessary to afford the requisite inertia for resisting the blow.

HAMMERFEST, the most northern town in Europe, is situated in the department of Hammerfest in the province of Finmark, on the western side of the island of Kvalö, "Whale Island," which lies off the northwestern coast of Norway. Its latitude is 70° 39' 15", and the sun stays for two months above its horizon. Though a small place of about 2,100 inhabitants, it is the seat of a considerable trade.

HAMMER-HEAD. (See SHARK.)

HAMMER-PURGSTALL, JOSEPH VON, was born at Gratz, in 1774, and after some training in the Oriental academy of Vienna entered the Austrian diplomatic service. His youth and early manhood were passed in the Levant, where he bent all his energies to the task of improving his acquaintance with Oriental literature, in which as early as 1796 he proved his interest by the translation of a Turkish poem. He did not again come forward as an author till 1804, when his *Encyclopædia of Oriental Learning* appeared. From that time there was little pause in his literary productiveness. For fifty years he wrote incessantly on the most diverse subjects, and his works were composed in most of the languages of Europe. Von Hammer did for Germany the same work that Sir William Jones did for England. He showed that Oriental subjects were not to be studied merely so far as they were connected with biblical theology, but were a worthy object of research for their own sake. For more than fifty years he persisted in

introducing Eastern authors and Eastern topics to the general reader, and there was a time when no Orientalist was more widely known and admired. Von Hammer died on November 23, 1856, at the age of eighty-two.

HAMMERSMITH, a town and parish in the county of Middlesex, England, situated on the north bank of the Thames, and now connected with London by continuous lines of streets.

HAMMOND, HENRY (1605-1660), a learned royalist divine of the church of England, was born at Chertsey in Surrey, August 18, 1605. He was educated at Eton, when in his fourteenth year he passed to Magdalen college, Oxford, becoming demy or scholar in 1619, and fellow in 1625. After graduating in arts he turned his attention to divinity; in 1629 he entered holy orders, and in 1631 became bachelor of divinity. Hammond received his doctor's degree in 1639, and in 1643 was promoted to the dignity of archdeacon of Chichester. He was a member of the convocation of 1640, and also, but nominally only, of the Westminster assembly of divines, which began its sittings in 1643. In the latter year Doctor Hammond was concerned in the successful rising at Tunbridge in favor of King Charles I., and was obliged to flee in disguise to Oxford, then the royal headquarters. He was imprisoned under the commonwealth, and died in 1660.

HAMON, JEAN LOUIS, one of the best known of French painters under the second empire, was born at Plouha May 5, 1831. In 1848 he made his appearance at the Salon with *Le tombeau du Christ* (Musée de Marseille), and a decorative work, *Dessus de Porte*. The works which he exhibited in 1849—*Une Affiche Romaine*, *L'Égalité au Sérail*, and *Perroquet jasant avec deux jeunes Filles*—obtained no marked success. Hamon was therefore content to accept a place in the manufactory of Sèvres, but an enameled casket by his hand having attracted notice at the London International Exhibition of 1851, he received a medal, and left his post to try his chances again at the Salon of 1852. *La Comédie Humaine*, which he then exhibited, turned the tide of his fortune; and *Ma sœur n'y est pas* (purchased by the emperor) obtained for its author a third-class medal in 1853. Hamon spent some time in Italy, chiefly at Capri, whence in 1864 he sent to Paris *L'Aurore* and *Un Jour de Fiançailles*. The influence of Italy was also evident in *Les Muses à Pompéi*, his sole contribution to the Salon of 1866, a work which enjoyed great popularity. His last work, *Le triste Rivage*, appeared at the Salon of 1873. He died on May 29, 1874.

HAMPDEN, JOHN, the eldest son of William Hampden, of Great Hampden, in Buckinghamshire, by Elizabeth, second daughter of Sir Henry Cromwell, and aunt of Oliver, the future protector, was born in 1594. By his father's death, when he was but a child, he became the owner of a good estate, and a ward of the crown. He was educated at the grammar school at Thame, and in 1609 he became a commoner of Magdalen college at Oxford. In 1613 he was admitted a student of the Inner Temple, and in 1619 he married Elizabeth Symeon. He first sat in parliament for the borough of Grampound in 1621. From that time he was a member of every succeeding parliament till he died, 1643.

To the biographer who does not wish to become an historian under the pretense of narrating the incidents of his hero's life, Hampden's career must appear to give little scope for narrative. The letters which he left behind him are few. His speeches are scarcely more numerous, and are extremely brief. In the early days of his parliamentary career he was content to be overshadowed by Eliot, as in its latter days he was content to be overshadowed by Pym, and to be commanded by

Essex. Yet it is Hampden, and not Eliot or Pym, who lives in the popular imagination as the central figure of the English revolution in its earlier stages.

Something of Hampden's fame no doubt is owing to the position which he took up as the opponent of ship-money.

During the last two parliaments of James and the first three parliaments of Charles, Hampden did not, so far as we know, open his lips in public debate, but he was unceasingly employed in committee work, for which he seems to have had a special aptitude. In 1626 he took active part in the preparation of the charges against Buckingham. In January, 1627, he was bound over to answer at the council board for his refusal to pay the forced loan. Later in the year he was committed to the gate house, and then sent into confinement in Hampshire, from which he was liberated just before the meeting of the third parliament of the reign, in which he once more rendered useful but unobtrusive assistance to his leaders.

When the breach came in 1629 Hampden is found in epistolary correspondence with the imprisoned Eliot, discussing with him the prospects of the Massachusetts colony, or rendering hospitality and giving counsel to the patriot's sons now that they were deprived of a father's personal care. It was not till 1637, however, that his resistance to the payment of ship money gained for his name the luster which it has never since lost. Seven out of the twelve judges sided against him, but the connection between the rights of property and the parliamentary system was firmly established in the popular mind.

In the short parliament of 1640 Hampden stood forth among the leaders, and in the long parliament, though Hampden was by no means a frequent speaker, it is possible to trace his course with sufficient distinctness. Unwearied in attendance upon committees, he was in all things ready to second Pym, whom he plainly regarded as his leader.

There was one point on which there was no agreement. A large minority wished to retain Episcopacy, and to keep the Common Prayer Book unaltered, while the majority were at least willing to consider the question of abolishing the one and modifying the other. On this subject the parties which ultimately divided the House and the country itself were fully formed as early as February 8, 1641. The details of the contest between Episcopacy and Presbyterianism will be more fitly told in connection with the life of Pym. It is enough to say that Hampden fully shared in the counsels of the opponents of Episcopacy.

Every day Hampden's conviction grew stronger that Charles would never abandon the position which he had taken up. He was therefore a warm supporter of the Grand Remonstrance, and was chosen out to be one of the five impeached members whose attempted arrest brought at last the opposing parties into open collision. In the angry scene which arose on the proposal to print the Grand Remonstrance it was Hampden's personal intervention which prevented an actual conflict, and it was after the impeachment had been attempted that Hampden laid down the two conditions under which resistance to the king became the duty of a good subject. Those conditions were an attack upon religion, and an attack upon the fundamental laws. There can be no doubt that Hampden fully believed that both those conditions were fulfilled at the opening of 1642.

When the civil war began Hampden levied a regiment of Buckinghamshire men for the parliamentary cause. In the earlier operations of the war, and in the undecided fight of Edgehill, he bore himself gallantly and well. But it is not on his skill as a regimental officer

that Hampden's fame rests. In war as in peace his distinction lay in his power of disentangling the essential part from the non-essential. In the previous constitutional struggle he had seen that the one thing necessary was to establish the supremacy of the House of Commons. In the military struggle which followed, he saw, as Cromwell saw afterward, that the one thing necessary was to beat the enemy. His precious life was a sacrifice to his unselfish devotion to the call of discipline and duty. On June 18, 1643, when he was holding out on Chalgrove Field against the superior numbers of Rupert till reinforcements arrived, he received two carbine balls in the shoulder. Leaving the field, he reached Thame, and after nearly six days he died on the 24th praying for his country and his king.

HAMPDEN, RENN DICKSON (1793-1868), bishop of Hereford, was born at Barbados, and entered as a commoner at Oriel College, Oxford, in 1810. Having taken his B. A. degree with first-class honors in both the classical and mathematical schools in 1813, he, in the following year, obtained the chancellor's prize for a Latin essay *On the Office of the Ephors at Sparta*, and shortly afterward he was elected to a fellowship in his college, Keble, Newman, and Arnold being among the number of his contemporaries. Having left the university in 1816 he held successively the curacies of Newton, Faringdon, and Hackney, and in 1827 he published *An Essay on the Philosophical Evidence of Christianity*. In 1828 he returned to Oxford as tutor of Oriel, and, after having twice acted as public examiner in classics, he was selected to preach the Bampton lectures in 1832, when he chose for his subject *The Scholastic Philosophy considered in its Relation to Christian Theology*. Notwithstanding a charge of Arianism brought against him by the Tractarian party, he, in 1833, obtained the principalship of St. Mary's Hall, in 1834 the chair of moral philosophy, and the regius professorship of divinity in 1836. There resulted a widespread and violent though ephemeral controversy, after the subsidence of which he published a *Lecture on Tradition*, which has passed through several editions, and a volume on *The Thirty-nine Articles of the Church of England*. His nomination by Lord John Russell to the vacant see of Hereford in December, 1847, was again the signal for a violent and organized opposition; and his consecration in March, 1848, took place in spite of a remonstrance by many of the bishops. He died in 1868.

HAMPSHIRE, HANTS, or SOUTHAMPTON, a maritime county in the south of England, is bounded on the north by Berkshire, on the east by the counties of Surrey and Sussex, on the south by the English Channel, and on the west by Wiltshire and Dorsetshire. It is of an irregular quadrilateral form, its greatest breadth from north to south, not including the Isle of Wight, is forty-six miles and its greatest breadth from east to west forty-one miles. The total area comprises 1,302,105 imperial acres (mainland portion 938,764 acres, Isle of Wight 93,341), or nearly 1,613 square miles. Hampshire in its general aspect presents a beautiful variety of gently rising hills and fruitful valleys, adorned with numerous mansions and pleasant villages, and interspersed with extensive woodland. Two ranges of low chalk hills, known as the North and South Downs, enter the county from Surrey and Sussex respectively, and traverse it in a northwesterly direction into Wiltshire and Berkshire. The coast on the whole is low and irregular. The most easterly part forms a large bay containing Hayling Island and Portsea Island, which divide it into Chichester harbor, Langston harbor, and Portsmouth harbor. From the southwestern extremity of Portsmouth harbor it runs about eighteen miles inland in a northwest direction, and forms South-

ampton Water, which has a western shore about ten miles in length, and an average breadth of nearly two miles at high water. From Southampton Water its line is continued irregularly in a southwestern direction—for nearly one-half of its extent fronting the Isle of Wight, and in its western half forming Christchurch Bay and part of Poole Bay.

The principal rivers are the Avon, the Boldre, the Exe, the Test with its tributary the Anton, the Itching, and the Hamble.

According to recent agricultural statistics, the total area of arable land was 706,927 imperial acres, of which 247,958 were under corn crops, 135,982 under green crop, 112,813 under rotation grasses, 184,141 permanent pasture, and 22,967 fallow. The acreage under woods was 87,229. The principal grain crop is wheat, for which Hampshire enjoys great celebrity. Its acreage has been gradually increasing, and at the time mentioned was 100,090. Hops are extensively grown in the eastern part of the county bordering on Surrey. Their acreage was 3,064. Farming is generally conducted on the best modern principles, but owing to the varieties of soil there is perhaps no county in England in which the rotation observed is more diversified, or the processes and methods more varied. Most of the farms are large, and there is a considerable number of modern farms. The waste land has been mostly brought under tillage, but a very large acreage of the ancient forests is still occupied by wood. New Forest has 60,000 acres under wood, was originally formed by William the Conqueror in 1079, after the battle of Hastings, and the greater part of it belongs to the crown. The trees of the forest are principally beach and oak. The oaks, many of which are some hundred years old, do not grow to a great height, but shoot out strong, crooked branches which give them a very picturesque appearance. Formerly they were chiefly used for the ships of the royal navy. Herds of small ponies similar to those of Shetland and the Hebrides are still reared in the forest. It also contains abundance of deer.

Among the eminent persons connected with Hampshire may be mentioned Young, author of *Night Thoughts*; Warton, author of the *History of English Poetry*; Dibdin, Bishop Wykeham, Pococke the traveler, Sir William Petty, Jonas Hanway, Brunel, Gilbert White, John Keble, and Charles Dickens.

HAMPSTEAD, a suburb of London, is situated in the county of Middlesex, on the slope of Hampstead Hill, four miles northwest of the city. Hampstead Heath, an irregular sandy tract occupying the summit and northern slope of the hill, and extending to two hundred and forty acres, is much frequented by excursionists and picnic parties. The hill is the highest in the vicinity of the metropolis, being four hundred and forty-three feet above the level of the Thames, or thirty-six feet higher than the cross of St. Paul's. At one time the village was a favorite resort of poets and other men of letters; and among the more famous of its old taverns was the Flask Inn, now converted into a private residence, the meeting-place of the Kit-Cat club, of which the more celebrated members were Addison, Steele, Richardson, Marlborough, and Walpole. The parish church of St. John is a plain brick structure in the Italian style, with a picturesque tower. The graveyard contains a number of monuments of eminent persons, including those of Sir James Mackintosh, Joanna Baillie, and Constable the artist.

HAMPTON, a village in the county of Middlesex, England, is situated on the north bank of the Thames, twelve miles west-southwest from Hyde Park Corner.

About a mile from Hampton village and close to the

river stands Hampton Court Palace, one of the finest extant specimens of the Tudor style of architecture, and formerly a royal residence. It was originally erected by Cardinal Wolsey, who in 1515 received a lease of the old mansion and grounds of ninety-nine years. As the splendor of the building seemed to awaken the cupidity of Henry VIII., Wolsey in 1526 thought it prudent to make him a present of it. It became Henry's favorite residence, and he made several additions to the building, including the great hall and chapel in the Gothic style. Of the original five quadrangles only two now remain, but a third was erected by Sir Christopher Wren for William III. The fine gardens, extending to forty-four acres, were laid out at the desire of William III. in the Dutch style, with elevated terraces, long shady walks, and a labyrinth called the "Maze," which is the source of great amusement to visitors. Bushy Park, opposite the palace gardens, is open to the public, and contains a celebrated avenue of chestnut trees. The palace was sold by the parliament in 1641, but afterward came into the hands of Cromwell; and it continued to be one of the principal residences of the English sovereigns until the time of George II.

HAMPTON, the capital of Elizabeth City county, Va., is situated at the mouth of the James river, on the north side of Hampton Roads, and has considerable repute as a watering-place. It is the seat of Hampton Normal Institute (colored), and possesses some manufacturing. There is a large trade in oysters and fish. Population (1890), 6,538.

HAMPTON ROADS, a roadstead at the mouth of the James river, separating Fortress Monroe from Sewall's Point, Va. It was the scene of the sinking of the United States war-vessel *Cumberland*, and destruction of the *Congress* by the Confederate iron-clad, *Merrimac*, in March, 1862. On the ninth of that month the *Monitor*, a vessel of novel construction, devised by John Ericsson, drove the Confederate vessel back toward Norfolk harbor, whence, on May 11th, she was taken to Craney Island and blown up by the Confederates, the detachment destroying her being under command of an English naval officer, Charles H. Harker, then in the service of the Confederacy.

HAMSTER (*Cricetus*), a genus of rodent mammals belonging to the *Muride* or mice family, and characterized by the possession of large cheek pouches. The common Hamster (*Cricetus vulgaris*) is somewhat larger and stouter than the Norway rat, but with a much shorter tail. Its fur, which varies somewhat in color, is generally of a reddish-brown above and black beneath, with several white spots on the sides. It is found throughout the dry regions of central Europe and Asia, from the Rhine eastward to the river Obi, and southward to Persia and the Caucasus. It is a burrowing animal, its subterranean dwelling consisting of several vaults, most of which are used as storehouses for the grain and seeds which the hamster lays up in autumn for consumption during winter and spring. In collecting this store it makes use of its cheek pouches, which are said to be large enough to contain a quarter of a pint, while the hoard of a single individual will sometimes contain about two bushels of grain. It is thus specially obnoxious to the farmer, who loses no opportunity of destroying the creature and of ransacking its stores. Like many other rodents the hamster is exceedingly prolific, the female producing several broods in the year, each consisting of over a dozen young, and these when not more than three weeks old are turned out of the parental burrow to form underground homes for themselves. The burrow of the young hamster is only about a foot in depth, while that of the adult descends four or five feet beneath the surface. On the

approach of winter the hamster retires to its subterranean abode, the various entrances to which it carefully closes, and there it remains until the advent of milder conditions, feeding, for a while on its well-garnered store, but becoming torpid during the coldest period of the winter.

HANAU, a town of Prussia, capital of a circle in the government district of Cassel, province of Hesse-Nassau, is situated at the confluence of the rivers Kinzig and Main, twelve miles east of Frankfurt. Hanau is the birthplace of the brothers Grimm, and the house in which they were born is now adorned with a medallion. In the neighborhood of the town are the electoral palace, with an extensive park and large orangeries, and the watering-place of Wilhelmsbad. Hanau is the principal commercial and manufacturing town in the province, and stands next to Cassel in point of population, which is (1890) 23,000.

HANCOCK, JOHN, statesman, was born at Quincy, Mass., January 12, 1737. Having taken his degree at Harvard university in 1754, he began a mercantile career, and on the death of an uncle in 1764 succeeded to a large fortune and a prosperous business. In 1768, two years after his election to the Massachusetts House of Representatives by the city of Boston, his sloop *Liberty* was seized for contravention of the commercial laws, and in the riot which followed the royal customs commissions barely escaped with their lives. After the "massacre" of Boston in 1770, Hancock inveighed with such spirit and bitterness against the troops and their officers, demanding their removal from the town, that he became obnoxious to the government; and afterward the attempt to seize his person led to the first revolutionary battle at Concord, Mass. In 1774 Hancock was president of the provincial congress, and from 1775 to 1777 of the general congress at Philadelphia, where he was the first to sign the declaration of independence. Returning to Massachusetts he assisted in framing the constitution, and in 1780 was chosen first governor. He was annually elected to this dignity till 1785, and again from 1787 to 1793, sitting as an ordinary member of the legislature in the interval. He received the degree of LL.D. from Harvard university in 1792. He died at Quincy, October 8, 1793.

HANDEL, GEORGE FREDERICK, one of the greatest names in the history of music generally, is absolutely paramount in that of English music. His influence on the artistic development of England and his popularity, using that word in the most comprehensive sense, are perhaps unequalled. He has entered into the private and the political life, as well as into the art life of Englishmen; without him they cannot bury their dead or elect their legislators; and never has a composer been more essentially national than the German Handel has become in England. It may on the other hand be said that but for his sojourn in that country, Handel would never have been what he was. It was under the influence of English poetry, and of English national and religious life, that his artistic conception broadened and gained the dignity and grandeur which we see in his oratorios, and which was wanting, and, seeing the style of art, could not but be wanting, in his Italian operas. George Frederick Handel (in German the name is always Händel) was born at Halle in Saxony on February 23, 1685, the same year which gave birth to his great fellow composer Johann Sebastian Bach. He was the son of George Handel, who, according to the custom of the time, combined the occupation of barber and surgeon, and subsequently was valet-de-chambre to the elector of Saxony. His father was sixty-three years old when Handel was born, and the musical talent shown by the youth at a very early age, found

little encouragement from the stern old gentleman, who looked upon art with contempt, and destined his son for the law. The boy's first attempts at composition date from an early period, and in his twelfth year he made his *début* as a virtuoso at the court of Berlin with such success that the elector of Brandenburg, afterward King Frederick I. of Prussia, offered to send him to Italy, a proposal declined by Handel's father for unknown reasons. In 1697 the latter died, and the young artist was henceforth thrown on his own resources. For some years he remained in Halle, where in 1702 he obtained a position as organist; but in the following year we find him at Hamburg, at that time one of the musical centers of Germany. There the only German opera worth the name had been founded by Reinhold Keiser, the author of innumerable operas and operettas, and was flourishing at the time under his direction. Handel entered the orchestra, and soon rose from his place among the second violins, to the conductor's seat at the *clavicembalo*, which he occupied during Keiser's absence. It was at Hamburg that he became acquainted with Mattheson, a fertile composer and writer on musical subjects.

The year 1705 witnessed Handel's first dramatic attempt—a German opera, *Almira*, performed at Hamburg on January 8, 1705, with great success, and followed a few weeks later by another work of the same class, *Nero* by name. In 1706 he left Hamburg for Italy, at that time still the great school for music, to which, indeed, Handel himself owed his skill and experience in writing for the voice. He remained in Italy for three years, living in Florence, Rome, Naples and Venice. His compositions, during his Italian period, were two operas, two oratorios, *Resurrezione* and *Il Trionfo del Tempo e del Disinganno*, afterward developed into the English oratorio *The Triumph of Time and Truth*, and numerous other choral work. It was during these years that the composer's earlier or Italian style reached its full maturity and that his name became widely known in the musical world. In the chief cities of Italy, "il Sassone," as Handel, like his countryman Hasse, twenty years later, was nicknamed, was received with every mark of favor and esteem. But his own country also began to acknowledge his merits. At Venice, in 1709, Handel received the offer of the post of capellmeister to the elector of Hanover. The composer at the time contemplated a visit to England, and he accepted the offer only on condition of leave of absence being granted to him for that purpose. To England accordingly Handel journeyed after a short stay at Hanover, arriving in London toward the close of 1710. Curiously enough he came as a composer of Italian opera, and in that capacity he earned his first success at the Haymarket with the opera *Rinaldo*, composed, it is said, in a fortnight, and first performed on February 24, 1711. The beautiful and still universally popular air "Lascia ch'io pianga" is from this opera. A similar air, in the form of a *sarabande*, occurs in *Almira*. After the close of the season in June of the same year, Handel seems to have returned to Germany for a short time; but the temptation of English fame or English gold proved too powerful, and in January, 1712, we find him back in London, evidently little inclined to return to Hanover in spite of his duties at the court there. Two Italian operas, the celebrated Utrecht *Te Deum*, written by command of Queen Anne, and other works, belong to this period. It was in such circumstances, somewhat awkward for the composer, when his deserted master came to London as George I. of England. Neither was the king slow in resenting the wrongs of the elector. For a considerable time Handel was not allowed to appear at court, and it was only through the intercession of his patron, Baron Kielman-

segge, that his pardon was at last obtained. Commissioned by the latter, Handel wrote his celebrated *Water-Music*, which was performed at a great *fête* on the Thames, and so pleased the king that he at once received the composer to his good graces. A salary of £200 a year granted to Handel was the immediate result of this happy consummation. In 1716 he followed the king to Germany, where he wrote a second German, "Passion," the words this time being supplied by Brockes, a well-known poet of the day. After his return to England he entered the service of the duke of Chandos, as conductor of his private concerts. In this capacity he resided for three years at Cannons, the duke's splendid seat near Edgware, and produced the two *Te Deums* and the twelve anthems surnamed *Chandos*. The English pastoral, *Acis and Galatea* (not to be mistaken for the Italian cantata of that name written at Naples, with which it has nothing in common), and his first oratorio to English words, *Esther*, were written during his stay at Cannons. It was not till 1720 that he appeared again in a public capacity, that of impresario of an Italian opera at the Haymarket theater, which he managed for the so-called Royal Academy of Music. Senesino, a celebrated singer, to engage whom the composer specially journeyed to Dresden, was the mainstay of the enterprise, which opened with a highly successful performance of Handel's opera *Radamisto*. *Muzio Scevola*, written in conjunction with Buononcini and Ariosti, *Tam-erlane*, *Rodelinda*, and other operas composed for the same theater, are now forgotten, only detached songs being heard at concerts. To this time also belongs the celebrated rivalry of Handel and Buononcini, a gifted Italian composer, who, by his clique, was declared to be infinitely superior to the German master. The controversy raised a storm in the aristocratic teapot, and has been generally, but erroneously, attributed to Swift, and in reality written by John Byrom:

Some say, compared to Buononcini,
That Mynheer Handel's but a ninny:
Others aver that he to Handel
Is scarcely fit to hold a candle.
Strange all this difference should be
'Twixt Tweedle-dum and Tweedle-dee.

The contest was essentially of a personal nature, and in these circumstances it is hardly necessary to add that Handel remained victorious. Buononcini for a reason not sufficiently explained left London, and Handel was left without a rival. But in spite of this his connection with Italian opera was not to be a source of pleasure or wealth to the great composer. For twenty years the indomitable master was engaged in various operatic ventures, in spite of a rival company under the great singer Farinelli, started by his enemies—in spite also of his bankruptcy in 1737, and an attack of paralysis caused by anxiety and overwork. Of the numerous operas produced by him during this period it would be needless to speak in detail. Only the name of the final work of the long series, *Deidamia*, produced in 1741, need be mentioned here.

It is a question whether Handel's change from opera to oratorio has been altogether in the interest of musical art. The opera lost in him a great power, but it may well be doubted whether dramatic music such as it was in those days would have been a proper mold for his genius. Neither is it certain that that genius was, strictly speaking, of a dramatic cast. There are no doubt in his oratorios—for in these alone Handel's power is displayed in its maturity—examples of great dramatic force of expression; but Handel's genius was in want of greater expansion than the economy of the drama will allow of. It was no doubt for this reason that from an inner necessity he created for himself the

form of the oratorio, which in spite of the dialogue in which the plot is developed is in all essentials the musical equivalent of the epic. This breadth and depth of the epic is recognized in those marvelous choral pieces expressive either of pictorial detail (as the gnats and the darkness tangible and impenetrable in *Israel in Egypt*) or of the combined religious feeling of an entire nation. By the side of these even the finest solo pieces of Handel's scores appear comparatively insignificant, and we cannot sufficiently wonder at the obtuseness of the public which demanded the insertion of miscellaneous operatic arias as a relief from the incessant choruses in *Israel in Egypt* at the second performance of that great work in 1740. The *Messiah* is the musical equivalent of Milton's *Paradise Lost*. This leads us to another and equally important aspect of the same subject—the important influence of English poetry on Handel's works. Not only are some of the greatest names of English literature—Milton (*Allegro and Penseroso*), Dryden (*Alexander's Feast*) Pope (*St. Cecilia's Ode*)—immediately connected with Handel's compositions, but the spirit of these poets, and especially of Milton, pervades his oratorios even when he has to deal with the atrocious doggerel of Morell or Humphreys. The following is a chronological list of Handel's English oratorios taken from the catalogue of his works appended to Mr. J. Marshall's article in Grove's *Dictionary of Music and Musicians*, vol. i. p. 657: *Esther* (1720), *Deborah* (1733), *Athalia* (1733), *Saul* (1738), *Israel in Egypt* (1738), *Messiah* (1741), *Samson* (1741), *Joseph* (1743), *Hercules* (1744), *Belshazzar* (1744), *Occasional* (1746), *Judas Maccabeus* (1746), *Alexander Balas* (1747), *Joshua* (1747), *Solomon* (1748), *Susanna* (1748), *Theodora* (1749), *Jephthah* (1751), *Triumph of Time and Truth* (1757). The sequence of these dates will show that the transition from Italian opera to sacred music was gradual, and caused by circumstances rather than by premeditated choice. The remainder of Handel's life may be told in few words. He for a second time became a bankrupt in 1745, but nothing, not even his blindness during the last six years of his life, could daunt his energy. He worked till the last, and attended a performance of his *Messiah* a week before his death, which took place on April 14, 1759. He was buried in Westminster Abbey. His monument is by Roubilliac, the same sculptor who modeled the statue erected during Handel's lifetime in Vauxhall Gardens.

HAND TOOLS. Within the limits of the present article it would be impossible to describe even the majority of the instruments which may come under this designation, including as it does (in its popular if not in its technical sense) the whole of the appliances used by the handicraftsman in the treatment, by means of his muscular energy, of the natural substances used in the arts and manufactures,—whether in the preliminary operations of setting-out and measuring his materials, in reducing his work to the required form by cutting tools or otherwise, in gauging it and testing its accuracy, or in duly securing it while being thus treated. Omitting therefore the large but by no means unimportant class of measuring and gauging instruments, straight edges, templates, etc., we will confine our attention to examples of those in the use of which an actual expenditure of force is necessary. According to the structure and other properties of the materials to be treated by them, these act almost without exception either by impact, by pressure, or by cutting, the last being effected sometimes with impact and sometimes with pressure. The principal tools acting purely by impact are noticed under HAMMER, (*q.v.*)

It should be observed that the term "cutting" is

applied to processes which have but little in common, the great differences of structure in the materials operated upon demanding equally great differences in the modes of effecting the desired end, which is in almost all cases the forcible separation of their particles in some regular and definite manner. If we regard, for example, the action of a sharp knife upon a piece of chalk as one of true cutting,—*i. e.*, the separation of its particles by the forcible insertion of a wedge-like blade of superior hardness to itself,—we shall find that in by far the larger proportion of instances this simple action is rendered complicated, either through the substance under treatment being insufficiently compact to afford in itself the necessary resistance, or through its want of homogeneity causing a tendency in it to part more readily in some directions than in others. Thus all kinds of wood and the generality of both vegetable and animal substances, being cellular or fibrous in their structure, offer so much less resistance in a direction parallel to the fibers than in one transverse to them that in the former case many of them may be parted by fissure without any true cutting at all. So also with crystalline materials—as is beautifully exemplified by the diamond, which lends itself to cleavage in certain planes in the most perfect manner, though the steel chisel which is employed for the process is very much inferior in hardness to itself. Metals also are frequently not homogeneous; indeed, they are sometimes said to be fibrous in structure, but it is only to a very limited extent, if at all, that they are so, and their great natural tenacity even then prevents the separation of their particles except by a true cutting process. Lastly, some stones and minerals, such as sandstones, are said to be cut, though they are formed of material considerably harder than the tools which are used upon them, the fact being that their hard particles are not cut at all, but are merely separated from one another when the cementing material which holds them together is compelled to give way.

Cutting or edge tools are mainly of two classes — (i.) cutting tools used with impact, and (ii.) cutting tools used mainly with pressure. These again may be subdivided into tools used (1) for wood and soft materials, (2) for metal, and (3) for stone and hard substances.

Wood-tools cutting by impact comprise all the varieties of axes and adzes, such as the ordinary English pattern of carpenter's ax, the woodman's felling ax, the wedge ax (which was one of the first American improvements in edge tools introduced into Europe), and the shipwright's adze, which last is a particular rapid and efficient tool in skillful hands. All these when used in the direction of the grain of the wood act by cleaving rather than by cutting, except when the thickness of the chip removed is so small that its transverse strength is inferior to the lateral tenacity of the fibers. So also do chisels and gouges when driven by blows from a hammer or mallet.

In the case of *metals* their hardness in general almost precludes the possibility of employing them upon any tools corresponding to the above. If we except a few special tools such as plumbers' knives, etc., chisels will be found to be almost the sole representatives of this class.

Tools of this class for *stone* also consist chiefly of chisels, the mason's chisel varying greatly in width of edge according to the variety of stone and the depth of the cut to be taken.

A sharp knife serves well for showing the different kinds of treatment by cutting or by fissure to which any particular wood or other moderately soft material is capable of submitting itself. The "thickness" of the cutting edge, or in other words, the angle which the

intersecting planes which include it form with one another, the degree of smoothness or roughness of edge which best effects the clean division or separation of the fibers, and the possibility or otherwise of producing a smooth surface by "scraping," can all to a great extent be judged of with the aid of a knife. And the subject is by no means an unimportant one. Consideration of the action which takes place at the edge of a cutting-tool, and the strain which this action produces on particular portions of it are frequently of service in enabling us successfully to meet the special cases which arise in practice, and may sometimes guide us toward remedying the defective action of the hand-tools in use for ordinary work. America has long taken the lead in originating thoughtful improvements of this kind, and the result is apparent in the rapid manner in which the use of edge tools and appliances of American patterns is now everywhere extending.

Cutting tools for *metal* analogous to the foregoing are but few as regards surface work. Their chief characteristic—at least in the case of those used for the harder metals—is the greatly increased thickness of their edges. Files of various cross sections, lengths, and degrees of fineness of tooth; and scrapers (which are merely thick knife-edges, and not unfrequently from worn-out files by sharpening them at the extremity), constitute about the only edge tools at the disposal of fitter or mechanic for finishing work that he has roughly surfaced with his chipping chisels.

Stone and hard materials cannot in general be treated by cutting tools simply with hand pressure, though some of the softer kinds of stone are carved with chisels used almost or altogether without impact, and are sawn with toothed saws resembling the cross-cut saws used for wood. Glaziers' diamonds were till recently the only tools for producing the peculiar "cut" requisite for starting the clean fracture by which sheet glass is divided, theirs, however, being a case of fissure rather than of true cutting. But of late years steel glass cutters have been introduced which act—as long as the sharpness of their edges is maintained—in a manner precisely similar. Diamonds, however, are used for cutting glass, stone, etc., by actually detaching their particles; writing diamonds and diamond drills have this kind of action.

Of subsidiary tools the vice is an absolute essential for the generality of metal workers. The ordinary tail-vice used by mechanics has not yet been largely superseded, though many ingenious arrangements have been devised or remedying its main defect, viz., the want of parallelism in the movement of the jaws.

Hand-vices are used in the manner implied by their name, without being attached to a bench like the foregoing. The screw wrench, which is used for turning nuts, etc., of various sizes, has of late been deservedly the subject of various improvements in which weight is sought to be saved without sacrifice of strength; and the shifting spanner, of which the duty is the same, has led to the exercise of much ingenuity without any perfectly satisfactory solution of the problem how it may best be constructed. The merit and simplicity of the ordinary screwdriver, on the other hand, are well known.

Instances of tools which afford a powerful grip by simple means are the blacksmith's tongs, the vice-chop tongs, the pliers and the pincers.

HANG-CHOW-FOO, a city of China, in the province of Che-Keang, about two miles northwest of the Tseentang-Keang, at the southern terminus of the Imperial Canal by which it communicates with Peking. It lies about 100 miles southwest of Shanghai. Toward the west is the Si-hu or "Western Lake," a beautiful sheet

of water, with its banks and islands studded with villas, monuments and gardens, and its surface traversed by gayly-painted pleasure boats. To the Chinese it is a very paradise. Exclusive of extensive and flourishing suburbs, the city has a circuit of twelve miles; its streets are well paved and clean, and it possesses a large number of arches, public monuments, temples, hospitals and colleges. It has long ranked as one of the great centers of Chinese commerce and Chinese learning. The silk manufactures alone are said to give employment to 60,000 persons within its walls, and it has an extensive production of gold and silver work and tinsel paper. On one of the islands in the lake is the great Wan-lan-ko, or pavilion of literary assemblies, and it is said that at the examinations for the second degree twice every three years from 10,000 to 15,000 candidates come together. In the northeast corner of the city is the Nestorian church, which was noted by Marco Polo, the façade being "elaborately carved, and the gates covered with elegantly wrought iron." There is a Roman Catholic mission in Hang-chow, and the Church Missionary Society, the American Presbyterians and the Baptists have likewise stations. The local dialect differs from the Mandarin mainly in pronunciation. The population, which is remarkable for gayety of clothing, was formerly reckoned at 2,000,000, but is now variously estimated at 300,000, 400,000, or 800,000.

Hang-chow-foo is the Kinsai of Marco Polo, who describes it as the finest and noblest city in the world, and speaks enthusiastically of the number and splendor of its mansions, and the wealth and luxuriance of its inhabitants. According to his authority it had a circuit of 100 miles, and no fewer than 12,000 bridges, and 3,000 baths.

HANKA, WENCESLAUS or WAKLAW (1791-1861), a Bohemian philologist, was born at Horeniowes, a hamlet of eastern Bohemia, on June 10, 1791. On September 16, 1817, Hanka made the discovery of some ancient Bohemian manuscript poems of the thirteenth and fourteenth centuries, in the church tower of the village of Kralodwor, or Königinhof. These were published, in 1818, under the title *Kralodworsky Rukopis*, with a German translation by Swoboda. Great doubt, however, was felt as to their genuineness; and Dobrowsky, by pronouncing *The Judgment of Libussa*, another manuscript found by Hanka, an "obvious fraud," confirmed the suspicion. But some years afterward Dobrowsky saw fit to modify his decision; and, in 1840, after a careful examination of the manuscripts by two eminent antiquaries, Hanka was ultimately vindicated. A translation into English, *The Manuscript of the Queen's Court*, was made by Wratislaw in 1852. The originals were presented by the discoverer to the Bohemian Museum at Prague, of which he was appointed librarian in 1818. In 1848 Hanka took part in the Slavonic congress, and other peaceful national demonstrations, being the founder of the political society, Slovanska Lipa. He was elected to the imperial diet at Vienna, but declined to take his seat. In the winter of 1848 he became lecturer, and, in 1849, professor of Slavonic languages in the university of Prague, where he died, January 12, 1861.

HANKOW (that is, the "Mouth of the Han"), the great commercial center of the middle portion of the Chinese empire, and since 1858 one of the principal places opened to foreign trade. It is situated on the northern side of the Yang-tse-kiang at its junction with the Han river, about 450 miles west of Shanghai at a height of 150 feet. By the Chinese it is not considered a separate city, but as a suburb of the now decadent city of Hanyang; and it may almost be said to stand in a similar relation to Wu-chang the capital of the prov-

ince of Hupeh, which lies immediately opposite on the southern bank of the Yang-tse-kiang. Hankow extends for about a mile along the main river and about two and a half along the Han. It is protected by a wall eighteen feet high, which was erected in 1863 at an expense of £250,000, and has a circuit of about four miles. In 1861 the port was declared open by James Hope and Sir Harry S. Parkes, and the site of a British settlement was selected in the east end of the town. Before the Taiping wars, the full brunt of which fell upon this part of the country, the sister cities of Hankow, Han-yang, and Wu-chang-fu had a population, it is said, of over 5,000,000. At present Hankow has from 600,000 to 800,000 (Sossnoffsky says only 300,000), and the other two from 400,000 to 700,000.

HANLEY, a market-town and municipal borough of Staffordshire, England, is situated in the center of the pottery district, eighteen miles north of Stafford. It owes its prosperity to its pottery manufactures, which include porcelain, encaustic tiles and earthenware, and give employment to the greater part of the population, women and children being employed almost as largely as men. In the neighborhood coal and iron are obtained. Hanley, which includes the former township of Shelton, received a municipal constitution in 1857. It is the central and most important of the group of towns constituting the parliamentary borough of Stoke-upon-Trent. The population of Hanley is 45,000.

HANNAY, JAMES, critic, novelist, and publicist, was born at Dumfries in 1827. He entered the navy in 1840 and served till 1845, when he adopted literature as his profession. In 1857 Hannay contested the Dumfries burghs in the Conservative interest, but without success. He edited the *Edinburgh Courant* from 1860 till 1864, when he removed to London. In July 1868 he was appointed British consul at Barcelona, a post which he occupied till his death on January 8, 1873. Hannay's best books are *Singleton Fontenoy*, *Satire and Satirists*, *Eustace Conyers*, and *Essays from the Quarterly Review*.

HANNIBAL. Hannibal is a very common Carthaginian name. Its final syllable *bal* occurs repeatedly as a suffix in Punic names, and is in fact taken from the chief Phœnician deity, Baal. The entire name denotes, according to a probable interpretation, "the favor of Baal."

The famous Hannibal, the hero of the Second Punic War, was the son of Hamilcar Barca, and was born in 247 B.C. He and his two brothers, Hasdrubal and Mago, were called by the father "the lion's brood." At the age of nine he begged his father, who was leaving Carthage for Spain, to take him with him. The request was granted, but not before he had sworn at that father's bidding on the altar of sacrifice eternal enmity to Rome. That vow determined his life's future. In Spain he was bred up in camps under his father's eye. He was present at the battle in which his father fell in 228 B.C., being then in his nineteenth year. Hamilcar's son-in-law Hasdrubal, succeeded to the command. Eight years afterward, in 221 B.C., he was struck down by an Iberian assassin. Meantime the young Hannibal had proved himself thoroughly able both to obey and to command, and the soldiers with one voice at once hailed him as their general.

His first object was to complete the work of his father and his father's successor. Spain, he felt, must be more thoroughly overawed, if it was to be the base of operations against Rome. He pushed into the heart of the country, crossed the Tagus, and crushed the resistance of the tribes of the interior. Two campaigns sufficed for the conquest of all Spain to the south of the Ebro, except Saguntum, a town considerably south of the Ebro

and some way to the north of the modern Valencia. It was a Greek colony from Zacynthus (Zante), and had grown into a rich and prosperous place, but, what was now far more important, it was in friendly relation with Rome. To attack it therefore would be like throwing down the gauntlet to the Roman Senate and people. But Hannibal was able to tell the home government at Carthage that the Saguntines were molesting Carthaginian subjects in the neighborhood. Without awaiting an answer he began the siege. Roman ambassadors at the solicitation of envoys from Saguntum landed on the coast, but were told by Hannibal that he could not see them. They went on to Carthage, but their remonstrances, though the subject of a long debate, were in vain. Eight months passed away, and Saguntum, after a gallant defense, was forced to surrender. Hannibal got a rich booty for his army, and went into winter quarters at New Carthage (Cartagena). Again a Roman embassy went to Carthage and insisted on his being given up. The demand was refused. By the close of the year 219 B.C. the Second Punic War was in fact begun.

Hannibal's resolution was now taken. He prepared at once to invade Italy. He had a numerous and efficient army and a well-filled exchequer. All who shrank from the expedition he dismissed to their homes. In the spring of 218 B.C. he began his great march from New Carthage with an army of 90,000 foot and 12,000 horse and thirty-seven elephants. The Ebro was easily crossed. In the country beyond he had some fighting to do with the native tribes, and there he left Hanno, with a force of 10,000 foot and 1,000 horse to secure the pass between Spain and Gaul. Again he sent back all in whom he saw signs of hesitation. With a considerably diminished army he passed the Pyrenees at Bellegarde and encamped at Iliberris (Elne). Some Gallic tribes, alarmed at his advance, had assembled in the neighborhood, but he soon conciliated their chiefs and persuaded them that he meant them no mischief. So he continued his march without molestation to the Rhone.

Meanwhile the Romans had done little or nothing to check their enemy. At last the consul, Publius Cornelius Scipio, arrived at Massilia (Marseilles), and was surprised to find that Hannibal was about to cross the Rhone. But he was too late to oppose the passage, and Hannibal crossed the river probably at some point near the village of Roquemaure. He then followed its course, marching up its left bank to its junction with the Isère at Valence, and entered what was known as the "Island of the Allobroges." It was from thence that he began his famous passage of the Alps.

The narrative of Polybius, though it raises some difficult questions, has conveyed to most modern students and scholars the impression that Hannibal crossed by the pass of the Little St. Bernard. Such high authorities as Arnold, Niebuhr and Mommsen regard the question as settled in its favor.

Fifteen days in all were occupied in the passage. The October of the year 218 B.C. saw the passage of the Alps accomplished, and Hannibal with his army encamped in northern Italy. Thus far he had been successful, but at a tremendous cost. His army was shrunk to a force of 20,000 infantry and 6,000 cavalry — the former being composed of Libyans and Spaniards, in about the proportion of three to two, and the latter being chiefly Numidians, and admirably efficient.

It was now five months since he had set out from New Carthage. His men, of course, sorely needed rest, and this they had for a brief space amid the friendly tribes of Cisalpine Gaul. It was now high time for the Romans to exert themselves. Scipio after quitting Mar-

seilles, whence he had sent on his army into Spain, had hurried back to Italy, and, on reaching Placentia, took command of the Roman army quartered there. He was, indeed, numerically weaker than Hannibal, and was deficient in cavalry. Still he advanced up the Po to meet him, and on the Ticino, somewhere, it would seem, near Vercelli, was fought the first engagement of the Second Punic War. It was a cavalry action, and the inferiority of the Romans in this arm was decisively proved. They were driven back with heavy loss, and Scipio himself was severely wounded, being rescued, it is said, by his son, a lad of seventeen, who subsequently became as famous as Hannibal himself, and had the good fortune to be his conqueror. He has come down to posterity as Scipio Africanus. The defeated general fell back to the walls of Placentia. Trebia, a southern tributary of the Po, was between him and the enemy, and he was soon joined by the other consul, Sempronius. Their united armies numbered not less than 40,000 men. Sempronius was for instantly giving battle; Scipio was still disabled by his wound. Sempronius had his way, and on a bitterly cold December day the Romans plunged into the swollen water of the Trebia in the face of a sleet storm and a cutting wind. They fought well, but when taken in flank by Hannibal's brother Mago, who was lying in ambush amid brambles and bushes in a watercourse, they broke and fled in utter rout.

This decisive victory gave nearly all northern Italy to Hannibal. He let his troops rest during the winter, and added to them a number of Gauls. Early in the spring of 217 B.C. he decided to cross the Apennines and to penetrate into the heart of Italy. The road from Cortona to Perugia skirts the northern shore of Lake Trasimene, and into this road, which is in fact a mountain defile, the Roman column unwarily entered. They were caught in a trap. Hannibal had posted his light troops on the hills on either side, while he himself blocked the outlet near Passignano with the best of his infantry. As soon as the Romans were in the pass they were assailed on all sides, and the battle soon became a mere massacre. The Roman army was destroyed, and Flaminius was among the slain. We might suppose that Hannibal would have now done well to have marched straight on Rome, and this the Romans expected. But he may well have thought that it would be better to wait the chance of insurrection among the Italian communities. So he marched through Umbria, and again crossed the Apennines into Picenum. He then marched southward along the coast into Apulia and encamped at Arpi. Meanwhile the Romans had made the famous Fabius Maximus their dictator. After levying an army of four legions, Fabius marched in pursuit of the enemy, having first effected a junction with the army under Servilius at Rimini.

From the first Fabius had decided on the policy which earned for him the name of the *Cunctator*, the Delayer. He dogged his enemy's steps, but would never risk an engagement. The richest districts of southern Italy were laid waste under his very eyes. But he could not be provoked into any rash movement. Once, indeed, it seemed as if Hannibal was himself entrapped. He had been ravaging Campania, and was on the point of retreating into Samnium, when Fabius posted a force at the head of the pass which afforded the only available means for his retreat. Hannibal is said to have driven a multitude of oxen with lighted fagots on their horns up the hills overhanging the road, so as to give the impression that he and his army were retreating over the heights. Fabius' detachment quitted its position to check the supposed movement, and thus gave Hannibal an opportunity of escaping through the pass. The tac-

tics of Fabius disgusted his men, and when he had to leave them for a time, he found on his return that his master of the horse, Minucius, on the strength of a small success won in his absence, was eager to bring on a general engagement. Fabius gave him a part of the army, with which Minucius ventured on an attack. He was on the brink of destruction, when he was rescued by the dictator's timely interposition. After this Hannibal went into winter quarters at Geronium, in the north of Apulia.

In the spring of the next year, 216 B.C., he moved south and pounced on Cannæ, where Roman supplies were stored up in great abundance. The town is about six miles from the mouth of the Aufidus and about eight from Canosa. The Romans were now again eager to strike a decisive blow. So a vast army was raised by the consuls of the year, Æmilius Paulus and Terentius Varro, numbering 80,000 infantry and 6,000 cavalry. Hannibal's army was probably far inferior numerically. The consuls on arriving in Apulia made Canusium (Canosa) their headquarters. For some few days the armies faced each other on the banks of the Aufidus. There were some preliminary maneuvers and skirmishes, till at last Varro, when it came to his turn to command, determined to fight. Both armies crossed the river, and Hannibal's men were drawn up within a loop which it forms near Cannæ. On either flank he stationed a strong body of his veteran infantry. His other infantry, ranged in the center in a crescent form, was soon driven in by the Roman legions, which had advanced to the attack in very deep formation. Meanwhile Hannibal's cavalry had put the Roman horse to rout, and had fallen on their rear. The Roman columns were now attacked also on either flank by the Carthaginian infantry and cut down without the possibility of resistance. The carnage is said to have been prolonged for eight hours. The Roman army was all but utterly destroyed. The consul Æmilius Paulus, nearly all the officers, and eighty senators, perished in the slaughter. Varro indeed escaped with a few horsemen to Venusia. The remainder were slain or made prisoners. It was at a comparatively small cost to himself that Hannibal won this great victory.

It might well be thought that such a victory would prove decisive, and that it must have been had Hannibal instantly pushed on to Rome. But he had probably good reasons for not doing so. He was, it must be remembered, as much as 200 miles from Rome; he would have had to march through still hostile populations, and by the time he would have arrived, he must have known that the first panic would have abated, and that the notion of carrying the city by a *coup de main* was simply preposterous. What he counted on was the dissolution of the Italian confederacy, and a widespread revolt throughout Italy. Nor was he altogether deceived. The disaster of Cannæ shook the loyalty of the Italian people. Rome was deserted by most of Apulia and Samnium, and almost wholly by the Lucanians and Bruttians. She retained indeed some strong fortresses, as Cales, Fregellæ, Casinum, Beneventum, Venusia, and these enabled her armies to maintain their ground. But Capua, in Campania, the richest and most powerful city in Italy after Rome itself, was lost to her. Thither Hannibal made his way from Cannæ, and there he went into winter quarters, which were perhaps too comfortable and luxurious. But the story that his men became utterly demoralized is absurd. They proved in the subsequent years of the war that they could move rapidly and fight bravely. We may indeed well suppose that by this time many of his veteran Spaniards and Africans had been replaced by native Italian soldiers. It is, however, clear that he still had a fine army. It is

true indeed, that after Cannæ his star seems to decline, but the explanation of this is that the Romans again reverted to the steady cautious tactics which they had learnt under Fabius. They too were for the most part well-officered. The ablest of their generals was Marcellus. Yet even he never beat his antagonist in anything like a pitched battle. The Romans after Cannæ made prodigious efforts. They sent three armies into the field, to watch and to check the enemy's movements. They kept themselves in strongly entrenched camps near fortresses which Hannibal had not the means of taking. Some indeed he did capture. At Cumæ, Neapolis, and Nola he was foiled. The two years after Cannæ, 215 and 214 B.C., passed without much being achieved on either side. Hannibal was vaguely hoping for reinforcements from Carthage, and for the aid of Philip, king of Macedon.

Next year, 213 B.C., he gained a considerable success. Tarentum surrendered, and so did Metapontum and Thurii. At Tarentum indeed the Roman garrison still clung to the citadel, and Hannibal could not dislodge it. From Carthage he had received a reinforcement of some elephants and of 4,000 Numidian cavalry, but this did not enable him to resume the offensive with much effect. Meanwhile Capua, besieged by two consular armies, seemed doomed to fall again into Roman hands. One of Hannibal's subalterns, Hanno, was defeated in the attempt to revictual the place. Hannibal himself hurried to its aid, but he could not bring the Romans to a battle, though he did temporarily raise the siege. The year 212 B.C., was one of mingled success and disaster for Rome. Syracuse that year had to surrender to Marcellus, and Carthage seemed to have quite lost Sicily. Here was an important gain for Rome. But in Spain the two brother Scipios had been cut off by Hasdrubal, who could now cross into Gaul and advance on Italy. And in Italy there had been some serious reverses. It would appear that there were actually six Roman armies in the field against Hannibal. One of these under Fulvius he destroyed in Apulia; another, made up of enfranchised slaves under Gracchus—a proof this of the extremity to which Rome was reduced—he put to rout, Gracchus himself perishing in an ambushade.

By the spring of 211 B.C., the Romans were besieging Capua with three armies. It was clear that the city must fall, unless Hannibal could come to its rescue. He made the attempt, but he could not break the hostile lines so strongly were they entrenched. Then he conceived the idea of drawing them off by menacing Rome itself. Now for the first time he marched through Latium and made it taste all the horrors of war. At last he encamped three miles from Rome on the Anio. But the Romans did not loose their presence of mind, or even relinquish the siege of Capua; they simply recalled Fulvius with one of the armies. There were two legions within the city, and Hannibal probably never meditated a serious assault. He ravaged the country up to the walls, but he did nothing more. Through Samnium he again marched into Apulia and thence into Bruttium, where he unsuccessfully attacked Rhegium and the citadel of Tarentum. Capua meanwhile was forced to surrender. This greatly discouraged Hannibal's Italian allies. Marcellus too had come back from Sicily after his capture of Syracuse. Altogether the year 211 B.C., was a very unpromising one for Hannibal. Next year, 210 B.C., however, he partly recovered lost ground by completely defeating the Roman prætor Cneius Fulvius at Herdonea, the modern Ortona, in Apulia. But he could not follow up this success, and his evident weakness led to the speedy return of Samnium and Lucania to the Roman

confederacy. The following year saw Tarentum slip from his grasp. But he soon had his revenge. Next year the two consuls, Crispinus and Marcellus, were both cut off and slain by the Numidian cavalry in the neighborhood of Venusia. Another disaster soon followed. A Roman army was besieging Locri in the extreme south. It was routed and indeed destroyed by Hannibal. Thus at the close of the year 208 B.C., the struggle was clearly by no means decided.

Rome had been making immense efforts. We hear of her having twenty-three legions under arms, and possibly the total number of her armies may have reached 200,000 men. The patriotic spirit of her citizens was still at the highest. But her finances were in a deplorable plight, and corn had risen to an almost famine price. The country round must have been woe-folly wasted, and multitudes reduced to beggary. One thing indeed the Romans had had to console them during these trying years. The Latin communities in Etruria and Latium had stood by them with wonderful fidelity. This had been their salvation. Now, in the years 209 and 208 B.C., came signs of discontent and wavering. Of the Latin colonies several declared that they could no longer furnish contingents or contributions. There were rumors too of a disloyal movement in Etruria. Worst of all, there came news in the autumn of 208 B.C. that Hasdrubal had crossed the Pyrenees. By next summer he would have passed the Alps. Should the two brothers unite their forces, Rome's fate, it could hardly be doubted, would be sealed. She was now in far greater jeopardy than she was even after the disastrous day of Cannæ.

The year 207 was thus a very anxious one. Claudius Nero and Marcus Livius were the consuls. The first was to watch Hannibal in Apulia, the other was to encounter Hasdrubal in Cisalpine Gaul. Livius retreated before the new invader, and let him reach Siena in Umbria, to the south of the river Metaurus without opposition. Thence Hasdrubal sent dispatches to his brother, who was at Canusium in Apulia. The plan was that they should join their armies at Narnia on the Flaminian road, between fifty and sixty miles from Rome. Unluckily for the two brothers the dispatches fell into the hands of Nero. His resolution was formed in a moment. Leaving the bulk of his army in its camp, he hurried northward with 7,000 men of his best troops, and after a rapid march of 200 miles he joined Livius. The two generals forced Hasdrubal to a battle. The Carthaginian was defeated and slain. Nero returned with all speed to his army, and informed Hannibal of the defeat and death of his brother by having the head of Hasdrubal flung into his camp. With that sight all hope must have died in Hannibal's heart. The battle of the Metaurus was indeed one of the decisive battles of the world. It decided the Second Punic War. From that time, for four more years, Hannibal could but stand on the defensive in the southernmost corner of the Italian peninsula. But even to the last no Roman general dared to close with him. Never in a single battle, as Polybius says, was he beaten while in Italy. Before quitting the country, he left a memorial of his wonderful achievements. In the temple of Juno on the Lacinian promontory, near Crotana, he inscribed on brazen tablets in Punic and in Greek an account of his expedition and his campaigns. Polybius saw the inscription and doubtless availed himself of it for his history. For fifteen years Hannibal had maintained himself in Italy, ravaging it from end to end, and inflicting upon the Romans according to their own calculation a total loss of 300,000 men. Now all was clearly over. After Nero's victory the Romans could afford to wait the course of events. Scipio had been

victorious in Spain, and early in 204 B.C. he was allowed to cross into Africa. Soon it was clear that he would threaten Carthage more effectively than Hannibal had ever threatened Rome. Hannibal received the order of recall at Crotona, and thence embarked for Africa. He landed at the smaller Leptis, on the coast of Tunis, late in the year 203 B.C., and lingered during the winter at Hadrumetum, the modern Susa. His brothers Hasdrubal and Mago had both fallen, and he was now the last of the "lion's brood." Fugitive as he was, his presence roused the Carthaginian spirit. The people would not hear of peace. Hannibal indeed attempted to negotiate, and had an interview with Scipio, but in vain. When he saw that he must fight, he could not have felt any of his old confidence. He had some good troops, but he was numerically inferior to the enemy. Of his veterans but few remained. The armies at last met at Zama, somewhere near the modern Keff. The battle was obstinately contested, and Hannibal's old soldiers died fighting in their ranks. But he never really had a chance of victory. Many of his men were raw mercenaries, and some of them deserted to the enemy. His army was utterly discomfited, and indeed annihilated. The defeat was not discreditable to him, but it was decisive. With a handful of men he escaped to Hadrumetum, and in the year 202 B.C. the Second Punic or, more properly, the Hannibalian War was at an end.

He was still only in his forty-sixth year. He soon showed that he could be a statesman as well as a soldier. Peace having been concluded, he was appointed chief magistrate of the state. The office had become insignificant, but Hannibal restored its power and authority. The oligarchy, always jealous of him, had even charged him with having betrayed the interests of his country while in Italy, and neglected to take Rome when he might have done so. The dishonesty and incompetence of these men had brought the finances of Carthage into grievous disorder. So effectively did Hannibal reform abuses that the heavy tribute imposed by Rome could be paid by installments without additional and extraordinary taxation. Carthage grew prosperous, and again the Romans trembled. Seven years after the victory of Zama they demanded Hannibal's surrender. They were still in mortal dread of their old enemy. Hannibal did not wish his countrymen to disgrace themselves, and he therefore at once became an exile. First he went to Tyre, the mother-city of Carthage, and thence to Ephesus, where he was honorably received by Antiochus, king of Syria, who was then preparing for war with Rome. Hannibal soon saw that the king's army was no match for the Romans. He advised him to equip a fleet and throw a body of troops on the south of Italy, adding that he would himself take the command. But he could not make much impression on Antiochus, who was a conceited man, quite ignorant of the strength of Rome. The story was told that, pointing to the great army he had assembled at Ephesus, he asked Hannibal if he did not think these were enough for the Romans. Hannibal's reply was, "Yes, enough for the Romans, however greedy they may be." The great army in which Antiochus had trusted was, in 190 B.C., routed by Scipio at Magnesia, near Smyrna. Again Rome demanded the surrender of Hannibal.

The end was now at hand. From the court of Antiochus Hannibal fled to Crete, but he soon went back to Asia, and sought refuge with Prusias, king of Bithynia. Once more the Romans were determined to hunt out the old man, and they sent Flamininus to insist on his surrender. Prusias was but a poor paltry princeling, and he promptly complied. Hannibal did not choose to fall into his enemies' hands. At Libyssa, on the eastern

shore of the Sea of Marmora, he took poison, which, it was said, he had long carried about with him in a ring. The precise year of his death was a matter of controversy. If, as Livy seems to imply, it was 183 B.C., he died in the same year as his great and victorious antagonist, Scipio Africanus.

HANNIBAL, a Missouri city, is the principal town of Marion county. It lies on the Mississippi river, 150 miles above St. Louis. It is of importance as a railway center, and the river is crossed here by a large iron railway bridge. The city has a considerable commerce over its various lines, and its banking and telegraph facilities are ample. Its principal commercial interest are centered in lumber, flour, meats, cattle, tobacco, grain, etc. It has car-works, machine shops, foundries and tobacco factories. Its educational and church accommodations are good. Coal mines are in operation in the country contiguous, as are also limestone quarries and lime kilns. Population (1890) 12,857.

HANNO (a very common Carthaginian name), according to the title of the *Periplus* that passes under the name, was a king of the Carthaginians who undertook an exploring and colonizing expedition along the northwestern coasts of Africa beyond the Pillars of Hercules, and on his return incised a narrative of his voyage in the temple of Saturn. There are no data to fix with any precision the time at which he flourished.

HANNO, the chief opponent of Hamilcar and Hannibal at Carthage. Few details are known of his life; his influence on the history of his country, which for more than forty years was very great, can be appreciated only from a detailed history of the period. During the first Punic war he conducted successfully a campaign against some African nation, and he soon became the most trusted leader of the aristocratic party. When in 240 B.C. Hamilcar's veterans returned from Sicily, clamoring for their promised pay, Hanno was sent to require them to accept partial payment; and on their rebellion he was appointed to the command against them. His unpopularity with the army, and his incapacity, led to several defeats, and the government was reluctantly forced to associate Hamilcar with him. After Hamilcar had at length crushed the rebellion, Hanno seems to have remained at Carthage exerting all his influence against the democratic party. During the Second Punic war he advocated peace with Rome; and he even, according to Livy (xxiii. 13), advised that Hannibal should be given up to the Romans. After the battle of Zama (203 B.C.) he was one of the ambassadors sent to Scipio to sue for peace, and after the war he is mentioned among the leaders of the Roman party.

HANOVER (German, *Hannover*), formerly an independent kingdom, but since 1866 a province of Prussia, is bounded on the north by the North Sea, northeast by Holstein, Hamburg, and Mecklenburg, east and southeast by Prussian Saxony and the duchy of Brunswick, southwest by Hesse Cassel and Westphalia, and west by Holland. These boundaries include the grand-duchy of Oldenburg, which stretches southward from the North Sea nearly to the southern boundary of Hanover. A small portion of the province in the south is separated from Hanover proper by the interposition of a part of Brunswick. The area of the province extends to 14,548 square miles.

The greater part of Hanover is embraced in that extensive plain which, commencing on the shores of the North Sea, terminates on the frontiers of Russia. The most fruitful districts are the banks of the Elbe and near the North Sea, where, as in Holland, rich meadows are preserved from being immersed in water by

broad dykes and deep ditches, constructed and kept in repair at great expense. It is only the southern portion that is mountainous; the district of Klausthal, containing the Harz, is wholly so, as well as some parts near Göttingen, and in the district of Hildesheim. The Harz mountains are not a part of any chain, but rise from a plain in an isolated group, the highest points of which are nearly in the center (see HARZ). They are covered with extensive forests. On the lower slopes the trees are of the deciduous kinds, but pines alone are found on the summits.

The whole of Hanover dips toward the north, and the rivers consequently flow in that direction. The Elbe, which forms the boundary on the northeast, receives the following tributaries:—the Ohre, which rises in the district of Lüneburg; the Aland and the Jetze, which come out of the province of Saxony, and are navigable in their lower course; the Ilmenau, which becomes navigable at Lüneburg; the Este, navigable to Buxtehude; the Lüle, navigable to Hornburg; the Schwinge, by which vessels reach Stade; the Oste, navigable to Kirchosters; and the Medem, which runs through the Hadeln-land, and admits large vessels up to Otterndorf. The Weser enters Hanover at Münden, being there formed by the junction of the Fulda and the Werra. It is navigable for barges from the spot at which the name commences; and it receives the Hamel, the Aller, the Oertze, the Leine, the Bohme, the Eyther, the Wümme, which in the lower part of its course takes the name of Lesum, the Geeste, and the Hunte,—all of them purely Hanoverian rivers. The Ems rises in the province of Westphalia, and after entering Hanover receives the waters of the Aa, the Haase, the Else, and the Leda, it falls into the Dollart near Emden, which is the principal seaport in the kingdom. It is navigable for flat-bottomed vessels from Rheina downward, and for sea-going vessels from Halte and Weener. The Vecht, a river of short course, rises in the province of Westphalia, and falls into the Zuyder Zee. A navigable canal from the Vecht to Münster connects that city with the Zuyder Zee. Navigable canals connect the various river systems.

The principal lakes are the Steinhuder Meer, about four miles long and two broad, and twenty fathoms deep on the borders of Schaumburg-Lippe; the Dümmersee on the borders of Oldenburg, about twelve miles in circuit; the lake of Bederkesa, and some others in the moorlands of the north; the Seeburger See near Duderstadt; and the Oderteich, in the Harz, 2,100 feet above the level of the sea.

The climate in the low-lying districts near the coast is moist and foggy, in the plains mild, on the Harz mountains severe and variable.

Though agriculture constitutes the most important branch of industry in the province, it is still in a very backward state. The greater part of the soil is of inferior quality, and much that is susceptible of cultivation is still lying waste.

Minerals occur in great variety and abundance. The Harz mountains are rich in silver, lead, iron, and copper; coal is found around Osnabrück, on the Dneister, at Osterwald, etc., lignite in various places; salt springs of great richness exist at Egestorfschall and Neuhall, near Hanover, and at Lüneburg; and petroleum may be obtained south of Celle. In the cold regions of the northern lowlands, peat occurs in beds of immense thickness.

Works for the manufacture of iron, copper, brass, wire, silver, lead, vitriol, and sulphur are carried on to a large extent. About 40,000 persons are employed in these works and in the mines, the yearly revenue from which amounts to £1,200,000.

Although the carrying trade of Hanover is to a great

extent absorbed by Hamburg and Bremen, the shipping of the province counts 867 sea-going vessels, the larger vessels all belonging to Geestemünde. Emden is destined to become a very important seaport when the extensive harbor improvements have been completed.

To the German parliament (reichstag) Hanover sends nineteen members; to the Prussian house of assembly (abgeordnetenhaus), thirty-six. The debts of the province, contracted before the occupation by Prussia, amount to £226,622.

By the census of 1875 the population had reached 2,017,393. There are 114 towns, but only nine have a population exceeding 10,000, viz.: Hanover, Osnabrück, Hildesheim, Linden, Harburg, Lüneburg, Celle, Göttingen, and Emden.

Among the educational institutions the university of Göttingen stands first, with an average yearly attendance of 900 students. There are besides eighteen gymnasiums, a progymnasium, nine first-class grammar schools, eleven normal and training schools, a polytechnic school at Hanover, a school of mines and forestry at Klausthal, several naval academies and schools of arts, three asylums for the deaf and dumb, two for the blind, and numerous other charitable institutions.

The word Hanover originally applied only to the city so called. It was gradually, however, extended to the country of which Hanover was the capital; and it was officially recognized as the name of the State when in 1814 the electorate of Lüneburg was made a kingdom.

In ancient times the country formed part of Saxony, which remained independent until the time of Charlemagne; and afterward it was included in the duchy of Saxony. After the extinction of the Billing family, which ruled Saxony for about two centuries, the duchy was granted to Lothair of Supplinburg, who in 1125 was elected emperor. There was a division in 1428, whereby were formed the so-called middle lines of Brunswick and Lüneburg. From 1527 Lüneburg was under the sole government of Duke Ernest the confessor, who was an ardent adherent of Luther, and so persistently labored to promote the Reformation in his country that it has been essentially Protestant ever since. He died in the same year as his friend Luther, 1546; and from him descended the younger lines of Brunswick and Lüneburg, or of Brunswick-Wolfenbüttel and Brunswick-Lüneburg. For in 1634 Duke Frederick Ulrich of Brunswick-Wolfenbüttel suddenly died childless, and his duchy was inherited by Augustus the younger, the descendant of Ernest's eldest son Henry; and Brunswick has remained in the hands of this dynasty till the present day. Meanwhile Lüneburg had been ruled over by William, the younger son of Ernest the Confessor; and when he died in 1592 he left seven sons, of whom four, Ernest, Christian, Augustus the elder, and Frederick, one after the other, became rulers of the land. Frederick, who survived all his brothers, died in 1648, the year in which the Thirty Years' War was brought to a close. In 1679 Ernest Augustus, reigning duke, married Sophia the grand-daughter of James I. of England. Ernest Augustus was an exceedingly ambitious prince, and in order to increase the power of his country introduced in 1682 the law of primogeniture. Afterward, in 1692, in consequence of a vast amount of negotiation and intrigue, he managed to secure for himself and his successors the electoral title. He died in 1698, and was succeeded by his son George Louis, who, having married his cousin Sophia Dorothea, the daughter of George William of Calenberg, finally united the two duchies on the death of the latter prince. In 1714 George Louis, the elector of Lüneburg, ascended the throne of Great Britain as George I. After this time, until the death of William IV., Lüneburg or Hanover

had the same sovereign as Great Britain; and this personal union of the two countries was not without important results for both. George II., as the ally of Frederick the Great in the Seven Years' War, joined the struggle in the capacity both of elector and of king; and while George III. was on the throne there was hardly a phase of the foreign policy of England by which Hanover was not affected. In 1803, when the Hanoverian troops capitulated at Sulingen, the country was invested by a French corps, which it had to maintain at a heavy cost. The Prussians received temporary possession of Hanover from Napoleon in 1806; but in 1807 a part of it was annexed to the kingdom of Westphalia, to which the remaining portion was added in 1810. The people never acquiesced in French predominance, and when the final struggle with Napoleon came they distinguished themselves by the ardor with which they flung themselves into it. At the congress of Vienna in 1815, it was demanded in the name of the elector (King George III.) that the electorate should be recognized as a kingdom; and not only was the demand admitted, but the new kingdom received considerable accessions of territory.

Partly through the influence of the French, partly in consequence of the general progress of ideas, Hanover was now, like many other parts of Germany, penetrated by a desire of freedom; and such had been the sufferings of the people, willingly borne for their sovereign and country, that they felt they had a right to be treated in a conciliatory and generous spirit. Their wishes were, however, disregarded. Count Münster, who virtually ruled the country from London, drew up a constitution which came into force in 1819. It was thoroughly reactionary in tendency, and the more resolutely it was enforced the more completely were the people alienated from the ruling class. Not until 1831, when there were several popular risings of so serious a nature that Count Münster resigned, was it deemed necessary to make important concessions, and even then the constitution which the states assembly prepared was made considerably less liberal by William IV. before he sanctioned it in 1833.

As the law of Hanover prevented a woman from mounting the throne, Ernest Augustus, duke of Cumberland, became king after the death of William IV. in 1837. He proved to be a harsh and narrow-minded despot. In 1837 he arbitrarily abolished the constitution of 1833, and when seven professors of the university of Göttingen protested against the act as unlawful, they were deprived of their chairs, and three of the most distinguished — Gervinus, Jacob Grimm, and Dahlmann — were banished from the country. The people were profoundly stirred, and it was hoped that the confederate diet might be induced to protect their rights, but it declined to interfere. A pitiful imitation of a constitution was granted in 1840, but this only intensified the public indignation, which became so strong that in 1848 the revolutionary movement that swept over Europe seemed about to overthrow King Ernest Augustus and his throne together. By hasty concessions he succeeded in preventing this catastrophe, but no sooner did the agitation begin to abate than he showed a disposition to evade the obligations imposed by the constitution which had been wrung from him. The comparatively liberal ministry which had been appointed in the moment of danger was dismissed in 1850, and probably only the death of the king in 1851 prevented him from engaging in as serious a contest as ever with the progressive forces that surrounded him. In 1849, when the Frankfort diet failed to establish the unity of Germany, he joined the kings of Prussia and Saxony in forming what was called "the three kings' alliance;" but he soon withdrew

from this connection, and associated himself with the thoroughly conservative policy of Austria. Ernest Augustus was succeeded by the blind son, George V. Personally King George was of an amiable disposition, but he shared his father's extravagant conceptions of royal rights, and at once appointed a ministry whose aim was to get rid of the inconvenient constitution of 1848. The second chamber, however, resisted its designs so energetically that in 1852 the more reactionary ministers had to resign, and in 1853 even the modified cabinet was completely defeated. The king then created a government which advised him to appeal to the confederate diet. This was done, and in 1855 the diet proclaimed the constitution of 1848 to be invalid. The states assembly was dissolved, and a ministry was formed, which boldly restored the nominal constitution of 1840. This government spared no effort to obtain an overpowering majority, but, as it still encountered some resistance in the new parliament, fresh elections were ordered, and in 1857 it had the satisfaction of meeting as pliant a body of deputies as the king himself could wish. The people, however, were not in sympathy with their nominal representatives, and gave many proofs of their discontent with the arbitrary rule to which they were subjected. In 1862, when an attempt was made to impose upon the schools the use of a catechism of the seventeenth century, the popular feeling was so decisively expressed that the king was compelled to dismiss his ministers. The new cabinet, which was rather less extravagant; included Herr Windthorst, who had for a short time had a seat in the government that resigned in 1853, and who has since acquired distinction as leader of the Ultramontane party in the imperial parliament of Germany. King George could not long submit even to a slight modification of his absolutist notions, and in 1865 intrusted Herr von Berries, who had done him faithful service in previous administrations, with the task of bringing together a cabinet to his liking.

Meanwhile, however, dangers had arisen in Germany, compared with which the internal troubles of Hanover were of small account. Herr von Bismarck, who now controlled Prussian policy, was devising methods for the realization of his vast schemes; and it became increasingly clear, after the Schleswig-Holstein war, that the minor states of Germany would soon have to accept finally the lead either of Prussia or of Austria. Before the outbreak of that conflict Hanover and Saxony had dispatched troops to Holstein for the purpose of executing the will of the bund. Although the federal army was driven back by Prussia, Hanover seemed for a time to be favorable to her rather than to Austria; but in reality the sympathy of the court was altogether with the latter power. On June 14, 1866, in regard to the decisive question whether the federal army should be mobilized, Hanover voted in the confederate diet with Austria; and by doing so she irrevocably declared on which side she would range herself in the approaching struggle. In consequence of this vote Prussia addressed an ultimatum to Hanover on June 15th, requiring her to maintain unarmed neutrality and to accept the scheme for the reform of the confederation which the Prussian plenipotentiary had submitted to the diet before retiring from it. As Hanover rejected these demands, Prussian troops at once crossed the frontier; and on June 17th they were in possession of the capital. On the 27th a battle was fought at Langensalza, in which the Hanoverians were victorious; but they could make no use of their victory, and were soon compelled to capitulate. At the conclusion of the war, by the treaty of Prague, Hanover, with Hesse, Nassau, and Frankfort, was annexed to Prussia. King

George addressed from Hietzing, near Vienna, a protest to the European cabinets, but it was disregarded; on October 3, 1866, his dominions were formally taken possession of, and in the following year the population were subjected to the Prussian constitution. In 1878 George V. died at Hietzing, but his son, Ernest Augustus, duke of Cumberland, maintains his right to the crown; and there is still a party in Hanover which expresses itself favorable to his claims. The mass of the population, however, whether originally willing to be annexed to Prussia or not, have submitted to the inevitable, and there is evidence that they are gradually becoming loyal subjects of the Prussian king.

HANOVER, the capital, is situated in the south of the above province, on a sandy but fertile plain on the river Leine, which here receives the Ihme, and is from this point navigable to the Weser. It is thirty-eight miles west-by-north of Brunswick by rail, one hundred and fifty-seven miles west of Berlin, seventy-eight southeast of Bremen, and one hundred and seven south of Hamburg. The Leine flows through the town, having the old town on its right bank, and the Calenberger new town between its left bank and the Ihme. The old town is irregularly built, with narrow streets and old-fashioned houses; while the new town has wide streets, handsome buildings, and beautiful squares. Of the latter, the most remarkable are—the square at the railway terminus, with an equestrian statue of King Ernest Augustus in bronze; the triangular theater square; George Square, with the statue of Schiller; Waterloo Square, with a column ninety-nine feet high, surmounted by Victory, and having inscribed on it the names of 800 Hanoverians who fell at Waterloo. In the gardens near the square an open rotunda has been erected inclosing a marble bust of Leibnitz, and near it a monument of General Alten, commander of the Hanoverian troops at Waterloo. The town has numerous churches; in the chapel of the palace are preserved the relics of saints which Henry the Lion brought from Palestine. The royal palace—built 1636–1640, rebuilt 1837—contains a picture gallery and collection of natural curiosities, and the palace of Ernest Augustus is remarkable for its historic collections, especially the famous Welfen museum. The other principal public buildings are the record office, containing a library of 150,000 volumes; the town-hall, built in the fifteenth century; the theater, the museum, the aquarium, the handsome railway terminus, and the exchange. Hanover has a number of colleges and schools, and is the seat of several learned societies. The town possesses large cotton-mills, iron-foundries, and machine factories, numerous tobacco manufactories, breweries, distilleries, etc. Hanover was the first German town that was lighted with gas. It is the birthplace of Sir William Herschel, the astronomer (1738–1822), of the brothers Schlegel, and of the historian Pertz; and the philosopher Leibnitz died there (1716). Population (1890), 139,330.

HANSARD, LUKE, English printer, whose name is familiar in connection with the parliamentary reports, was born July 5, 1752, and obtained in 1772 a situation as compositor in the office of Mr. Hughs, printer to the House of Commons. In two years' time he was made a partner, and undertook almost the entire conduct of the business, which in 1800 was resigned completely into his hands. The promptitude and accuracy with which Hansard printed parliamentary papers were often of the greatest service to the government—notably on one occasion, when the proof-sheets of the report of the secret committee on the French revolution were submitted to Pitt twenty-four hours after the draft had left his hands. Hansard died in 1828.

HANSEATIC LEAGUE. The word "hansa,"

when we find it first in the Gothic Bible of Ulfila, signifies a military assemblage or troop. From this comes the general sense of union, and especially in the Middle Ages of union for mercantile purposes. A later but less important meaning is that of a tax paid by traders for the right of forming such a union.

The Hansa, the league which ultimately overshadowed all rivals, and usurped the name for itself, was no intentional creation, and we can fix no exact date for its origin. It arose gradually from two elements, the union of German merchants abroad, and the union of German towns at home.

The first impulse to mercantile union came from the dangers of traveling in the early Middle Ages. A common depot, or "factory," became the central point of the union or Hansa, formed by the merchants. The union soon received a corporative constitution. At its head stood the elders, whose chief functions were to administer justice and to represent the society in its relations to the natives of the country. It was by means of these orderly unions that the German merchants obtained their important privileges, chiefly advantages in trade and taxes, from the people among whom they sojourned.

Cologne, the first German town which obtained great importance both at home and abroad, possessed at an early date a guild-hall, and all Germans who wished to trade with England had to join their guild. This soon included merchants from Dortmund, Soest and Münster, in Westphalia; from Utrecht, Stavern and Groningen, in the Netherlands; and from Bremen and Hamburg on the North Sea. But when, at the beginning of the thirteenth century, the rapidly rising town of Lübeck wished to be admitted into the guild, every effort was made to keep her out. The intervention of the emperor Frederick II. was powerless to overcome the dread felt by Cologne toward a possible rival to its supremacy. But this obstacle to the extension of the league was soon overcome. In 1260 a charter of Henry III. assured protection to all German merchants. A few years later Hamburg and Lübeck were allowed to form their own guilds. The Hansa of Cologne, which had long been the only guild, now sinks to the position of a branch Hansa, and has to endure others with equal privileges. Over all the branch Hansas rises the "Hansa Alamanniæ," first mentioned in 1282.

The league between Lübeck and Hamburg was not the only, and possibly not the first, league, among the German towns. But it gradually absorbed all the others.

In the fourteenth century the Hansa changes from a union of merchants abroad to a league of towns at home. In 1330 mention is first made of the Hansa towns, where before it had been the Hanse merchants. In 1343 the league is first designated as the Hansa by a foreign prince, Magnus of Norway, and thus acquires a diplomatic position as a united state.

The league thus formed would scarcely have held long together or displayed any real federal unity but for the pressure of external dangers. The true function of the Hansa, and especially of the Baltic towns, was to conduct the commerce between the east and west of northern Europe. But the geographical position of the Scandinavian countries enabled them to interpose a bar to this commerce. Thus from an early period the Hansa stood in a position of watchful hostility toward those countries. It was the careful maintenance of this watch over the Baltic which gave Lübeck its position in the league, and which gave the league its political as contrasted with its mercantile character.

During the fifteenth century the Hanse towns were frequently compelled to seek safety in arms. Their constant policy was to break up the union of Calmar. In

1428 they sent a large fleet against Eric, Margaret's successor, who wished to add Schleswig and Holstein to his possessions. The accession of two German princes, Christopher of Bavaria, and Christian I. of Oldenburg, to the Danish crown was due in no slight measure to the exertions of the Hansa. On the whole the league held its own in this century, though not without considerable and increasing difficulty.

But with the sixteenth century the Hansa begins really to decline. The English and Dutch proved formidable rivals for the commercial supremacy in northern Europe. Henry VII. secured in 1489 a treaty from Hans of Denmark, which gave England the right of commerce in the northern seas, and which enabled English merchants to found mercantile establishments in the ports.

Besides these causes of decline, the domestic position of the Hanse towns had altered very much for the worse. While in other countries the power of the feudal nobles had fallen before the rapid rise of the monarchy aided by the sympathy of the commons, in Germany alone the power of the princes had constantly increased, at the expense of both king and people. The reformation and the consequent secularization of church property in northern Germany only served to strengthen the hands of the lay princes. Such a state of things was fatal to the independence of a town league, which had always stood opposed to the lawless independence of the nobles. Gradually most of the towns fell off from the league. Foreign countries triumphed at the fall of their former successful rival. In Elizabeth's reign the Hanse merchants in London lost the privileges which they had held since the time of Henry III.

Religious disturbances and the fearful disasters of the Thirty Years' War completed the work thus begun. The peace of Westphalia restored the form but not the reality of the league. In 1669 the last general assembly was held. Henceforth the name of Hanse towns was kept by Lübeck, Hamburg, and Bremen, but it was to designate their independence, not their union.

HANSEN, PETER ANDREAS (1795-1874), astronomer, was born at Tondern, in the duchy of Schleswig. In 1825 he was selected to succeed Professor Encke as director of the observatory of Seeberg, near Gotha. There he remained for the rest of his life, devoting his talents to the development of the highest branches of mathematical astronomy, with an originality of conception which was acknowledged by the English Royal Astronomical Society on two occasions, by the award of their gold medal for his researches in physical astronomy and his lunar tables. His *Tables de la Lune* appeared in 1857, published at the expense of the British Government; they have been adopted for use in the calculations of the *Nautical Almanac*. Hansen was the author of a large number of miscellaneous astronomical papers, principally relating to the orbits of comets and planets or to perturbational astronomy. In one of these he was the first to point out that Encke's value of the horizontal equatorial solar parallax required to be increased to reconcile the lunar theory with modern observations,—an opinion which was subsequently confirmed by Le Verrier from his planetary researches, and by the observations of Mars and the transit of Venus of 1874. Hansen was a foreign member of the Royal Society, and an associate of the Royal Astronomical Society.

HANSTEEN, CHRISTOPHER, astronomer and physicist, was born at Christiania, Norway, September 26, 1784. He took in 1812 the prize of the Danish Royal Academy of Science for his reply to a question on the magnetic axes. Appointed lecturer in 1814, he was in 1816 raised to the chair of astronomy and applied

mathematics in the university of Christiania. In 1819 he published his researches on terrestrial magnetism. In 1835-38 his text-books on geometry and mechanics were published. He also contributed various papers to different scientific journals, and superintended the trigonometrical and topographical survey of Norway, begun in 1837. He was a member of the Royal Society of London, the French Institute, the American Academy of Arts and Sciences, and the Academies of Berlin and St. Petersburg. Hansteen died at Christiania, April 15, 1873.

HANUSCH, IGNAZ JOHANN (1812-1869), Bohemian savant and philosopher, was born at Prague on November 28, 1812. At the universities of Prague and Vienna, where he afterward studied, he directed his attention successively to theology and law, and finally, under the influence of Hegel's writings, to philosophy. After temporarily supplying in 1835 the place of Lichtenfels, professor of philosophy at Vienna, he was next year appointed ordinary professor of philosophy at Lemburg, whence he passed in the same capacity to Olmütz in 1847, and two years later to Prague. There he began a successful course of philosophy in the Czech language, but in 1852 was abruptly suspended from teaching, owing to his leanings toward Slavism. In 1860 he was nominated director of the imperial university library at Prague, where he died May 9, 1869.

HANWAY, JONAS (1712-1786), an English traveler and philanthropist, was born at Portsmouth. He is popularly known as the first Englishman to carry an umbrella in his native country; this he persisted in using in spite of all the efforts of the hackney coachmen to hoot or hustle him into conformity.

HAPARANDA, from *Haaparanta*, "Aspen-shore," a small town of Sweden in the district of Tornea, at the northern end of the Gulf of Bothnia.

HAPSBURG, or HABSBURG (Hawkscastle), an old German family which has given sovereigns to Germany, Spain, and Austria, takes its name from the old Swiss castle of Habsburg, situated on the river Aar in the canton of Aargau. The first mention of the countship of Habsburg is in a document of 1099, where the name Werner, count of Habsburg, occurs in connection with the consecration of the monastery of Muri as confirming the grants of the pious foundations made by his ancestors. This Werner of Habsburg was a nephew of Werner, bishop of Strasburg, who built the castle of Habsburg about the year 1020. The succession of the family cannot be traced between this period and the time of the emperor Frederick Barbarossa, but in a document whose date is May 30, 1153, Werner II. and his son Albert the Rich are mentioned as counts of Habsburg. Albert died in 1199, and was succeeded by his son Rudolf the Old, who, as a reward for placing a large sum of money at the disposal of Frederick II., received from him the countship of Aargau. Rudolf left behind him two sons, Albert the Wise and Rudolf II., who shared the possessions between them, and founded respectively the lines of Hapsburg-Hapsburg and Hapsburg-Laufenburg. The Laufenburg line also divided into two branches, the former of which became extinct in 1408 and the latter in 1415. Laufenburg thereupon fell to Austria. Albert the Wise of Hapsburg-Hapsburg was married to the countess of Kyburg, who was descended from the dukes of Zähringen, and related to the emperor Frederick II. From this union there was born on May 1, 1218, Rudolf, the founder of the royal dynasty of Hapsburg. He was elected king of Germany in 1273, and after the defeat and death of Ottocar, king of Bohemia, in 1278, at Marchfeld on the Danube, he annexed to his possessions Austria, Styria, Carinthia and Carniola. On the death of Rudolf in 1291 Adolf,

count of Nassau, was elected his successor to the German crown. The greater part of the original lands of the house were gradually lost by the victories of the Swiss Confederates, who finally in 1474 obtained Aargau, in which the castle of Hapsburg was situated. Philip, son of Maximilian I. and of Donna Juana of Spain, ascended the Spanish throne in May, 1506, and on his death in September of the same year, he was succeeded by Charles I., who was chosen emperor in 1519, and was thenceforth known as Charles V. In 1521 Charles granted his Austrian possessions to Ferdinand I., who became the head of the Austrian dynasty. The Spanish branch became extinct in 1700 with the death of King Charles II., and the male line of the Austrian branch became extinct with the death of the emperor Charles VI. in 1740; but the Austrian house was continued in the female line by Maria Theresa, who by her marriage with Francis of Lotharingia, chosen emperor in 1745, founded the line of Hapsburg-Lotharingia, from which the present imperial dynasty of Austria is descended.

HĀPUR, or HAPOOR, an ancient town of India in the Meerut district, Northwestern provinces, lies on the Meerut and Bulandshahr road, eighteen miles south of the former city. Population (1890), 18,000.

HARAN, or CHARRAN, is the name of a fertile district in the north of Mesopotamia (Padan-aram or Aram-naharaim), and also of a town situated some ten miles southeastward of Edessa (Orfa), on the banks of the small river Belik about fifty miles to the north of its junction with the Euphrates.

HARAR, HERER, HURRUR, HARRAR-GAY, or ARARGE, a city of northeastern Africa, in the country of the Gallas, at one time the capital of the province of Hadiyah in the Zayla empire, for a long period a small independent state under an emir of its own, and since 1876 subject to the Egyptian crown.

HARBORS AND DOCKS. All harbors may be classed either as havens for the protection of ships during storms, or as ports suited for commercial purposes. Of the first mentioned class, or those which are called harbors of refuge, some are natural and some artificial.

The designing of harbors constitutes confessedly one of the most difficult branches of civil engineering. In order the better to understand the nature of the difficulties which beset the marine engineer, let us suppose that he is called upon to design works for the accommodation of shipping in a given locality. The questions which immediately press on his attention are: What is the cheapest kind of design that is suitable for the place and sufficient for the class of shipping which has to be accommodated? and what are the smallest sizes of materials and thickness of walls that are admissible in its construction, as on these the cost of the work will materially depend.

Harbors of Refuge and Anchorage Breakwaters consist of one or more breakwaters, so arranged as to form a safe roadstead, which shall be easily accessible to the largest vessels in all states of the weather and tide. A breakwater forms a barrier either complete or partial to the progress of the waves, and is intended for sheltering the anchorage ground under its lee. It is not used for commercial traffic as are piers or quays, and therefore a parapet is not necessarily required for preventing the waves from breaking over the top, although this may be useful as a protection against the wind.

A harbor for commercial purposes is any arrangement of piers or breakwaters, or of both, which incloses and so tranquillizes a sheet of water, that vessels may be moored at the quay walls or wharves which form the inner sides of the piers. Where the coast line lies open to a very heavy sea it is often found necessary to make a double or compound harbor. In such a case the en-

trance to the inner basin is situated within the sheltered area formed by the outer works.

A straight pier generally projects at right angles to the coast line, with a free end at its seaward extremity; and, unless when the wind blows right in upon the shore, a straight pier will always afford some shelter on its lee side.

A quay wall is usually built parallel to the line of shore. It affords no shelter of any kind, and the only advantage which it possesses is that of enabling vessels to load and unload without their having to "beach," or, where the shores are steep, even to take the ground.

The local characteristics which demand consideration are the geological and other physical considerations of the shore; the exposure; the force of the waves due to the exposure; the strength, direction, and range of the tides; the depth of the bay or sea in which the harbor is to be built; the proximity of deep water to the works, or in other words, the slope of the foreshore; and the angle at which the heaviest waves impinge on the coast line and on the works.

Harbors of refuge are distinguished from tidal harbors mainly by the superior depth of water which they possess and the larger area which they inclose. The requisites are—shelter during storms, good holding ground, and easy access for shipping at any time of tide and in all states of the weather. A breakwater, though a passive, is yet a real agent, having true work to do. During storms many thousand tons of water are elevated and maintained above the sea-level; and a breakwater has to stop the onward motion within a given space or else to change the direction of their movement. There are two ways in which this work can be performed. One is by means of a plumb wall to alter the direction of the moving water by causing it to ascend vertically, and then to allow it to descend vertically, by which process the waves are reflected and sent back seaward. Another mode is to arrest the undulations by a sloping wall of length sufficient to allow the mass of elevated water to fall down upon the slope. If, however, the slope is not long enough to enable the waves to destroy themselves, they will, though reduced in height, pursue their original direction and pass over the top of the breakwater. In this case the breakwater does not do its full amount of work, and imperfect shelter is obtained.

Of the first kind of harbor that of Chicago, on Lake Michigan, is probably the best specimen in existence. The scope of the work has enlarged to meet the rapidly increasing demand of the phenomenal commercial growth of the city. We give a brief description of the work:

"The work on the harbor was begun in 1833, and continued intermittently until 1870, when it was decided to extend the original plans, and include a commodious exterior harbor. These plans were again finally modified in 1878, so that the completed harbor will include a sheltered area sixteen feet in depth, covering 270 acres, with communicating slips along the lake front covering 185 acres, making a total of 455 acres: this, in addition to the Chicago river, with which the outer harbor communicates. There is, also, an exterior breakwater, one-third of a mile north of the end of the north pier, so situated as to protect vessels entering the mouth of the river. The length of this outer breakwater will be 5,436 feet, of which 3,136 feet have been completed. The north pier, measuring from the outer end of the Michigan street slip, is 1,600 feet long, and extends 600 feet beyond the easterly breakwater, which latter, beginning at the outer end of the south pier, extends directly south 4,060 feet, and is distant 3,300 feet from the present shore line south of Monroe street.

A channel 800 feet wide intervenes between this and the north end of the southerly breakwater. This latter breakwater continues for a short distance due south, then turns at an angle of 30° , and extends in a south-westerly direction to within about 1,550 feet of the present shore line, and 500 feet from the dock line. This breakwater is 3,950 feet in length. The line of wharves and slips will be ended, and the southern end of the harbor completed, by the magnificent wharf to be built by the Illinois Central Railroad Company at Thirteenth street. It will extend to the government dock line. There is a light-house on the shore end, and a beacon light on the lake end of the north pier, and a beacon light on the south end of the easterly breakwater. The Life Saving Station is at the lake end of the northernmost railroad wharf, directly adjoining the south pier.

"On the inner harbor, the wharfing privileges occasioned much dispute, until 1833, when they were defined, the wharves being sold or leased in perpetuity, on payment of their value, and an annual rental of one barleycorn. In 1857 there were but six miles of dock, while at the present time there are twelve miles of slips and slip-basins, and the twenty-nine miles of river front are mostly docked. It happens not infrequently that more than a thousand vessels winter in this harbor."

Docks are of two kinds, viz., dry or graving docks, and wet or floating docks. The dry or graving dock is a small water-tight chamber, fitted with gates of timber or iron, which are shut against the rising tide after a vessel has entered for the purpose of being repaired. The water below low tide level is pumped out generally by steam power. The wet dock or tide basin is a large water-tight inclosure, usually several acres in extent, which is also fitted with gates which are closed, not, however, during the flowing but the ebbing tide, so that the vessels lying at the quays within the basin may remain constantly afloat and nearly at the same level while being loaded and unloaded.

In order to extend the time during which vessels can enter or leave a wet dock there are two additional works which are often connected with it. These are the entrance-lock and the outer or half-tide basin. The lock is a narrow chamber of just sufficient length and breadth to admit a ship of the greatest length and breadth of beam that is expected to frequent the port. Such a lock can, in absence of the largest class of ships, accommodate simultaneously three or four vessels of smaller tonnage. Locks are sometimes made with double gates, so that when only one vessel of small size has to enter, she is shut up within a compartment of the lock, by which means some of the water is saved which would have been expended had the whole of the chamber been filled. Shortly after the tide has begun to ebb, and when the gates of the wet dock have been shut, in order to prevent the water from falling too low in the dock, a vessel can still enter or leave by means of the lock. She is first passed into the lock from the sea; and, the lower or sea gates being closed, the sluices in the upper or dock gates are opened, which raises the water in the lock chamber to the same level as the water in the dock, when the upper gates are opened to let the vessel pass in. Ships leaving the dock after the tide has begun to fall are passed into the lock chamber, when the upper gates are closed and the sluices in the lower gates are opened, until the water in the lock has fallen to the same level as the tide outside, when the lower gates are opened and the vessel goes out to sea. This system of locking is continued so long as the level of the dock is not so much depressed as to affect the loading or unloading of vessels lying at the quays, or until the tide has ebbed so far as to prevent vessels reaching the lock from the sea.

The tide basin may be described as a lock of very large dimensions capable of receiving at the same time a considerable number of vessels, which continue to run into it from the sea after the dock gates have been finally closed for that tide. Such vessels can run in, so long as they have sufficient water over the sill of the sea gates of the basin, or until the basin itself is filled with ships. The sea gates are then closed, and the sluices in the upper gates are opened till the water in the basin is on a level with the water in the dock. The ships are then passed continuously into the dock, in a string, one after the other. By means of this arrangement the traffic can be carried on to a far greater extent than is possible with a narrow lock, which has to be filled and emptied for each vessel that enters or leaves the harbor.

The peculiar advantages of docks are the following. Vessels can be accommodated in the smallest possible space, are enabled to lie constantly afloat; whereas in tidal harbors, where they take the ground, they are apt to be strained or to have their floors broken. But there are other sources of mischief than this in open harbors, for often, when the tide is ebbing, vessels, unless watched, fall against each other. Then there is the chafing of the vessel's sides against the quays in exposed harbors where there is a run of sea, and the breaking of warps during stormy weather or during land floods, where there is a river.

Among the largest and best-sheltered harbors of the Old World are those of Portsmouth and Plymouth, in England, Milford Haven, in Wales, and Queenstown and Lough Foyle, Ireland. France has the magnificent harbor of Cherbourg, on the improvement and fortification of which many millions have been expended, and that of Marseilles on the south. By Australians the harbor of Sydney is claimed to be one of the finest in the world. Of American sea-board harbors that of New York accommodates an enormous trade. All along the Atlantic sea-board from Halifax, Nova Scotia, to Norfolk Roads, good harborage abounds. Charleston, S. C., Port Royal, Tampa Bay, and the Bay of Mobile furnish safe anchorage for large fleets. On the Pacific coast San Francisco has one of the finest harbors of the world, and Puget Sound abounds in good harbors.

HARBOR GRACE, a port of entry and second town in importance of Newfoundland. Considerable proportion of the trade of Newfoundland centers here. The harbor is large, but unprotected from the sea. The town is the see of a Catholic bishop. It has banks and cable and telegraph connections. Population (1890) about 8,000.

HARBURG, a seaport town of Hanover, Prussia, at the head of a circle in the district of Lüneburg, is situated on the left bank of the southern branch of the Elbe opposite Hamburg, which stands on the right bank of the northern branch of that river. Population (1890), 20,000.

HARDENBERG, FRIEDRICH VON, German poet and philosopher, best known as Novalis, was born on his father's estate in the county of Mansfeld, in Prussian Saxony, May 2, 1772. After attending the gymnasium of Eisleben he went as a youth of eighteen to the university of Jena, where he studied philosophy, mathematics, and the natural sciences. There he was treated with great kindness by Schiller, of whom he was a warm admirer. He studied law in Leipsic and Wittenberg, and in 1794 settled for a time in Tennstädt in order to perfect himself in the practical work of the legal profession. He died on March 25, 1801. After his death his writings were issued in two volumes by his friends Ludwig Tieck and Friedrich Schlegel, and were rapidly recognized as important contributions to German liter-

ature. They are for the most part composed of fragments, of which the chief is *Heinrich von Ofterdingen*, an unfinished romance.

HARDENBERG, KARL AUGUST, Prussian statesman, was born at Esselroda in Hanover, May 31, 1750. Having studied at Leipsic and Göttingen, he entered the Hanoverian civil service as chamber counselor in 1770. In 1787 he received the office of president of the board of domains in Brunswick. Frederick William II. was so impressed by Hardenberg's appearance and character that in 1790 he recommended him as a minister to the margrave of Anspach and Baireuth. These principalities being united to Prussia in 1791, Hardenburg was appointed a Prussian cabinet minister, but continued to perform his duties as chief administrator of the new province. In the war with the French republic he acted as minister of war, and in 1795 signed on behalf of Prussia the treaty of peace concluded at Basel. When Frederick William III. mounted the throne in 1797, Hardenberg was nominated the chief of the departments for Magdeburg and Halberstadt, for Westphalia, and for Neuchâtel. At this time the foreign policy of Prussia was determined by Haugwitz, who was on all occasions subservient to Napoleon. When in 1803 Prussian interests seemed to be threatened by the French occupation of Hanover, Haugwitz fell into disrepute, and in the following year his place at the head of the cabinet was taken by Hardenberg. The latter was anxious to maintain peace, but when in 1805 Napoleon's troops marched through Anspach he strongly protested, and entered into a convention with Russia. The victory of the French at Austerlitz, however, made it difficult for Prussia to proceed to hostilities; and on December 15, 1805, Haugwitz signed a convention with Napoleon, whereby in return for Hanover Prussia conceded Anspach, Cleves, and Neuchâtel to the French. Hardenberg then retired, and Haugwitz returned to power. After the battle of Jena Hardenberg undertook the office of foreign minister; but when the treaty of Tilsit was signed he withdrew and watched from a distance the vigorous and enlightened efforts of Stein to restore new life to the fallen and humiliated state. Stein being compelled to retire in 1810, Hardenberg was recognized as the only possible successor of the great minister; and he amply justified the confidence with which he was honored. He steadily prepared for the inevitable struggle with France by carrying out Stein's far-reaching schemes of social and political reorganization. The military system was completely reformed, serfdom was abolished, municipal institutions were fostered, the civil service was thrown open to all classes, and great attention was devoted to the educational needs of every section of the community. In the war of liberation Hardenberg was one of those who did most to stimulate the patriotic enthusiasm not only of the Prussians but of all Germans, and so important were his services that on June 3, 1814, after he had signed the first treaty of Paris, he was raised to the rank of a *fürst* or prince. He accompanied the allied sovereigns to London, was one of the chief plenipotentiaries at the congress of Vienna, and took a leading part in the negotiations which led to the second treaty of Paris. He died at Genoa, November 26, 1822.

HARDERWIJK, a town of the Netherlands, in the province of Guelderland, on the coast of the Zuyder Zee, about twenty-eight miles northeast of Utrecht. Population (1890), 6,000.

HARDICANUTE, **HARTHACNUT**, or **HARDIKNUT**, the last of the Danish sovereigns of England, son of Canute, king of England, was born in 1018 or 1019. When Canute died in 1035 Hardicanute was ruler of Denmark, and Swend, the elder reputed son of Canute

by Alfgiva of Northampton, one of his concubines, was ruler of Norway. It is said to have been the wish of his father that Hardicanute should be ruler of both England and Denmark, but his connection with Denmark seems to have been prejudicial to his English interests; and though his claims were supported by Godwine and the West Saxons, the witenagemot which met at Oxford decided that his government should not extend further north than the Thames, and that Harold, Canute's younger son by Alfgiva of Northampton, should reign over the northern provinces, being also in all probability overlord of the whole kingdom. Hardicanute refused, however, to come to England on such conditions, and in 1039 the witan of Wessex deposed him, and chose Harold also for their king. On the death of Harold in 1040, Hardicanute, who was about to invade England, had his hostile intentions disarmed by the message which reached him at Bruges, making him an offer of the crown for which he was preparing to do battle. The witan's choice of him seems to have been spontaneous, and not at all due to the threatening attitude he had assumed; but apparently he had not forgotten the former slight he had received, and his short reign was marked by great oppression and cruelty. He caused the dead body of Harold to be dug up from its place of sepulture at Westminster, and thrown into a marsh, or, according to another account, into the Thames; he exacted so heavy a *danegeld* for the support of his foreign fleet that great discontent was created throughout the kingdom, and in Worcestershire a general uprising took place against the earls sent to collect the tax, upon which he burned the city of Worcester to the ground and devastated the surrounding country; in 1041 he permitted Eadwulf, earl of Northumbria, to be treacherously murdered, after having granted him his full friendship. It would appear that Hardicanute was greatly given to excess in eating and drinking, and while carousing at the marriage feast of one of his thegns he was suddenly seized with an epileptic fit, from which he died a few days afterward, June 8, 1042. He had no children, and though the line of Danish sovereigns might have been continued by Swend, the choice of the kingdom was unanimous for Edward Atheling, son of Ethelred.

HARDING, JAMES DUFFIELD (1798-1863), a landscape painter, was the son of an artist, and took to the same vocation at an early age, although he had originally been destined for the law. He died December 4, 1863.

HARDING, JOHN. See **HARDYNG**.

HARDINGE, HENRY HARDINGE, VISCOUNT, field-marshal and governor-general of India, was born at Wrotham in Kent, March 30, 1785. After passing a short time at Eton college, he entered the army in 1798 as an ensign in the Queen's Rangers, with whom he served in Canada. In the Peninsular War he served for a time on Wellington's staff, and received an appointment as deputy quartermaster-general in the Portuguese army from Marshal Beresford, whose approval and subsequent influence he had won by his gallantry at Corunna in 1809. Hardinge was present at nearly all the battles of the campaign; he was wounded at Vimiera and Vittoria. At Albuera he saved the day for the British. When peace was again broken in 1815 by Napoleon's escape from Elba, Hardinge was appointed commissioner at the Prussian headquarters. He was present at the battle of Ligny, June 16, 1815, where he lost his left hand by a shot. In 1820 and 1826, Sir Henry Hardinge was returned to parliament as a member for Durham; and in 1828 he accepted the office of secretary for war in Wellington's ministry, a post which he also filled in Peel's cabinet in 1841-43.

In 1830 and 1834 he was chief secretary for Ireland. In 1844 he succeeded Lord Ellenborough as governor-general of India, a position which he retained till January, 1848. During his term of office the Sikh War broke out; and the governor-general after the battle of Mudki offered to serve as second in command under Lord Gough. He manifested all his old courage and skill, and at the peace, for his services in the campaign, he was created Viscount Hardinge with a Government pension of £3,000 for three lives; while the East India Company voted him an annuity of £5,000. He returned to England in 1848, and in 1852 succeeded the duke of Wellington as commander-in-chief of the British army. While in this position he had the home management of the Crimean War, which he endeavored to conduct on Wellington's principles — a system not altogether suited to the changed mode of warfare. In 1855 he was promoted to the rank of field-marshal. Viscount Hardinge resigned his office of commander-in-chief in July, 1856, owing to failing health, and died on September 24th of the same year at his house near Tunbridge Wells.

HARDOI, a British district of Oudh, India, under the jurisdiction of the lieutenant-governor of the North-Western Provinces, with an area in 1878 of 2,285.64 square miles. The district is an irregular parallelogram between the Gumti and Ganges; its greatest length from northwest to southeast is seventy-eight miles; and the average breadth is forty-six miles. It is bounded on the north by Sháhjahánpur and Kheri; east by Sítápur, the Gumti forming the boundary-line; south by Lucknow and Unáo; and west by Farrukhábád, the Ganges marking the boundary. Population estimated at 1,000,000.

HARDOUIN, JEAN, was a classical scholar of the seventeenth century. He was born at Quimper, in Brittany, in 1646, and died at Paris in 1727.

HARDT, HERMANN VON DER, Orientalist, was born at Melle, in Westphalia, in 1660, and died February 28, 1746.

HARDWAR, or HURDWAR, an ancient town of India, and place of pilgrimage, in Saháranpur district, northwestern provinces, situated on the right bank of the Ganges at the foot of the Siwálik hills. Population, 4,800.

HARDY, ALEXANDRE (1560-1631), the most fertile of all dramatic authors, next to Lope de Vega and Calderon, merits a place in dramatic literature on that account and no other. He is said to have written upward of six hundred plays, of which forty-one were printed in his own edition of 1624-28.

HARDYNG, or HARDING, JOHN, an English rhyming chronicler of the fifteenth century, was born in 1378 and died about 1466.

HARE, the common name of all the species, excepting the rabbit, of *Leporidae*, a family of rodent mammals, distinguished from the rest of that order by the possession of four incisor teeth in the upper jaw, two in front, which are well developed and longitudinally grooved, and two exceedingly small ones behind. The molars are formed for the mastication of vegetable food, an uneven surface being produced by the presence of transverse enamel plates which are worn down more slowly than the intermediate dentine. The teeth are without permanent roots, and thus the constant waste at the surface is compensated for by continuous growth at the opposite extremity. Hares all possess long ears, and in most species the hind legs are much longer than those in front. They are, without exception, timid, defenseless animals, although during the breeding season two males have been known to fight together for possession of the female until one was killed; while all the species are protectively colored. They form a single

genus (*Lepus*), containing from thirty-five to forty species according as certain forms are regarded as independent species, or merely as geographical varieties. They occur in all the great zoölogical regions of the world, but are especially characteristic of the northern and temperate areas of both hemispheres.

The common hare (*Lepus timidus*) is a typical example of the family. The ears in this species are longer than the head, and its hind legs are so long in comparison with those in front, that it is only by descending a hill diagonally that it can avoid overbalancing itself. It is found in all parts of Europe except the north of Russia, the Scandinavian peninsula, and Ireland, and is specially abundant in those countries in which it enjoys the protection of game laws. Its fur is usually of a tawny gray color above and white beneath, with the upper surface of the short tail and the tips of the ears black. The color of the fur, however, differs considerably in different latitudes and at different seasons of the year, showing, for example, a tendency to become white during the winter in northern countries, while assuming a reddish-yellow hue in the more genial climate of southern Europe. The hare is a night-feeding animal, remaining during the day on its "form," as the slight depression is called which it makes in the open field, usually among grass. This it leaves at nightfall to seek the fields of young wheat and other cereals whose tender herbage forms its favorite food. It is also fond of gnawing the bark of young trees, and thus often does great damage. In the morning it returns to its form, where it finds considerable protection in the close approach which the color of its fur makes to that of its surroundings; should it thus fail, however, to elude observation it depends for safety on its extraordinary fleetness. On the first alarm of danger it is said to sit erect and to reconnoiter, when it either seeks concealment by clapping close to the ground, or takes to instant flight. In the latter case its great speed, and the cunning endeavors it makes to outwit its canine pursuers, form the chief attractions of coursing. The hare takes readily to the water, where it swims well. Hares are remarkably prolific. They pair when scarcely a year old, and the female brings forth several broods in the year, each consisting of from two to five leverets (from the French *lièvre*), as the young are called. These have their sight at birth, and after being suckled for a month they are able to look after themselves. In Europe this species has never been known to breed in confinement. The hare was well known to the ancient Greeks and Romans.

The American varying hare (*Lepus americanus*) is one of the most widely distributed species of this family, extending, in one or other of its four geographical varieties, from the borders of the Arctic barren grounds southward to New Mexico. It differs from the mountain hare of Europe in its smaller size and relatively smaller ears, but resembles it in the change of color in the fur, especially of the northern varieties, during winter. It is exceedingly abundant on the banks of the Mackenzie river, where it is killed in great numbers by the Hare Indians. A favorite device among the Indians for catching it, according to Darwin, is to walk spirally round and round it, when on its form, especially at midday when the shadow of the hunter is shortest. It has still more implacable enemies, however, in the wolves, gluttons, and lynxes of those regions, of the last of which it is said to form the principal food. The fur of this species is imported into Great Britain, but it is of little value. In the swampy district of the southeastern portion of the United States, the swamp hare (*Lepus aquaticus*) and the marsh hare (*Lepus palustris*) occur. These take readily to the water, and are said to

dive for some distance, their legs being less thickly clothed with hair than are those of the less amphibious species. They feed chiefly on aquatic plants. The "jack-rabbit" of the far west is a species of hare.

HARE, JULIUS CHARLES, theological writer, was born at Valdagno, near Vicenza, in Italy, in 1795. In 1822 he was appointed assistant-tutor at Trinity college, which position he retained for ten years. Hare took priest's orders in 1826; in 1832 he succeeded to the rich family living of Hurstmonceaux in Sussex, where he accumulated a library of some 12,000 volumes, especially rich in German literature. In 1851 he was collated to a prebend in Chichester; and in 1853 he became one of the queen's chaplains. He died in 1855.

HAREBELL, or, as the name is often written, **HAIRBELL**, know as the Blue-bell of Scotland, and witches' thimbles, a well-known perennial wild flower. The harebell has a very slender slightly creeping root-stock, and a wiry, erect stem. The radical leaves, to which the specific name refers, have long stalks, and are roundish or cordate, crenate or serrate; the lower stem leaves are ovate or lanceolate, and the upper ones linear, subsessile, acute and entire, rarely pubescent. The flowers are slightly drooping, arranged in a panicle.

HAREM, or less frequently **HARAM**, the recognized European title of that portion of a polygamist's house which is devoted to the exclusive occupancy of his wives and their attendants, or, by a simple metonymy, for the female portion of his household. The word *harem* is Arabic for anything forbidden or not to be touched. It is generally applied in Moslem law to such things as games of chance, draughts, chess, witchcraft, and portrait taking, which are inconsistent with the religious code, and under the form of haram it is well known even to Europeans as designating the sacred inclosure of the principal mosque at Cairo and at Jerusalem. The word *seraglio*, which is not unfrequently employed as equivalent to harem, is an Italian modification of the Persian term *serai*, which simply means a palace or large building, as in the familiar compound *caravanserai*. Wherever polygamy is maintained in the midst of a developed social life, the harem appears to be an almost inevitable institution. We consequently find it after a more or less rigid type among the Jews, the Babylonians, the Siamese, the ancient Persians, the Peruvians, etc. But it is among the modern Mahometan peoples that it has attained its most perfect development; and the harems of the sultan of Turkey and the shah of Persia may be taken as the most elaborate and best-known specimens of the type.

According to the Koran, the Mussulman is required to satisfy himself with four wives, but the sultan may possess as many as seven. Each of these has her own suite of apartments, her own garden and bath-room, her own body of servants, male and female. They are not called by their names, but distinguished as *Kadin* (or Lady) Number One, *Kadin* Number Two, and so on. The title of sultana is bestowed only on the mother, the sister, or the daughter of a sultan; and consequently it is the *kadin* who first gives birth to an heir to the empire who alone can have this distinction. She further obtains the title of *hasseky* or *kasseki*, but this is lost if the child dies. All the female slaves, or as they are called *odalisks* (a European corruption of the word *odalik*, from *oda* a chamber, and *lik* belonging to), are at the absolute disposal of the sultan, and if, in spite of the natural endeavors of the *kadins* to prevent such a contingency, one of them become the mother of her lord and master's first-born, she is advanced to the rank of sultana *hasseky*. It is contrary to etiquette for the sultan to select his own favorites among the *odalisks*;

he is expected to accept the choice made for him by his mother, who bears the title of *validé*, and exercises great influence not only in the affairs of the harem but even in political matters. An old and devoted favorite of the sultan occupies the post of *kehaya chatun*, or lady-superintendent of the harem. A large body of eunuchs, both black and white, are employed as guards and gate-keepers. The white eunuchs have charge of the outer gates of the *seraglio*, but they are not allowed to approach the women's departments, and obtain no posts of distinction.

HARIKARI (rather *Hara-kiri*, belly-cut, also called happy despatch), a term applied to the curious Japanese system of official suicide, obsolete since 1868. All military men, and persons holding civil offices under the government, were held bound, when they had been convicted of any offense, to rip themselves up. This they performed by two gashes, in the form of a cross. Japanese duels were carried out in a similar fashion, and he who declined to kill himself was held infamous.

HARFLEUR, the Harflew of the older historians, a maritime town of France in the department of Seine Inférieure and arrondissement of Havre, about six miles east of Havre on the railway between that city and Rouen. Population, 2,000.

HARGREAVES, JAMES. See COTTON.

HARIÂNÁ, or **HURREEANAHA**, a tract of country in the Punjab, India, consisting of a level upland plain, interspersed with patches of sandy soil, and largely overgrown with brushwood.

HÄRING, WILHELM (1797-1871), German novelist, known as Willibald Alexis, was born at Breslau, and served as a volunteer in the campaign of 1815. On his return he studied law for some time at the universities of Berlin and Breslau, but he soon gave up the legal profession and devoted himself to literature.

HARINGTON, SIR JOHN (1561-1612), was the son of Mr. John Harington, and Queen Elizabeth's godson. He studied at Eton and at Christ's College, Cambridge, where he took the degree of M.A., his tutor being Bishop Still, the famous author of *Gammer Burton's Needle*. He came up to London about 1583 and studied law, but Queen Elizabeth seems to have removed him to a place at court. Tradition relates that it was at her command that he undertook the translation of Ariosto's *Orlando Furioso*, a work that saw the light in 1591 and was reprinted in 1607 and 1634. Soon after this first date, Harington retired to the family mansion at Kelston. In 1596 he published, in succession, *The Metamorphosis of Ajax*, *An Apology*, and *Ulysses upon Ajax*, the three forming collectively a very absurd and indecorous work of a Pantagruelistic kind. In 1608 he wrote a personal satire against the bishops, which he read to James I., but which was first published by a Presbyterian printer, as late as 1653, under the title of *A Brief View of the State of the Church*.

HARÍRÍ, Abu Mohammed al Kasim ibn 'Alí Ibn Mohammed ibn 'Othman, surnamed EL HARÍRÍ, was born at Bussorah, 1054-55 A.D., and died in 1121 or 1123, being therefore contemporary with the first crusade. His native city was renowned for its school of grammar, a most important science among a people whose every rule of religion and of life depended upon the accurate interpretation of some word or passage of the Koran, or some saying of the prophet. The rival school of Kufa was the only one that approached it in fame or glory, and in all the numerous disputes that took place between the two academies, Bussorah is generally allowed to have had the advantage. His great work is the *Maekámát*, or "assemblies," in which a series of anecdotes of a very slight character in the career of an imaginary learned vagabond afford the only

portunity for the display of vast philological and literary learning.

HARLEQUIN. See PANTOMINE.

HARLEY. See OXFORD, EARL OF.

HARLINGEN, or HAARLINGEN, in Frisian *Harns*, an important trading town and seaport in the province of Friesland in the Netherlands. Population (1890), 13,000.

HARMODIUS, a beautiful Athenian of the tribe Gephyraei, was the intimate friend of Aristogiton, a citizen of the middle rank. Hipparchus, younger brother of the tyrant Hippias, was also a lover of Harmodius. He tried to attract Harmodius to himself, and failing in the attempt, revenged himself by putting a public affront on his sister at a solemn festival. Thereupon the two friends conspired with a few others to murder both the tyrants during the armed procession at the Panathenaic festival, (514 B.C.) But in a sudden alarm they prematurely attacked and slew Hipparchus alone. Harmodius was cut down on the spot by the guards, and Aristogiton was soon captured and tortured to death.

HARMONIA, wife of Cadmus. The Theban legends (see CADMUS) have been so modified and systematized by poets and logographers that we must look to Samothrace with its old religious rites for an explanation of the myth. There Harmonia is said to have been the daughter of Zeus and Electra, while her brother Iasion was the founder of the mystic rites which were celebrated annually on the island. When Cadmus came to Samothrace, and was initiated, he received Harmonia as his wife.

HARMONICA is the technical name for the "musical glasses" with the learned conversation about which the pseudo-ladies from town astonish the simple-minded vicar of Wakefield. An instrument for producing musical sounds by means of drinking glasses touched with the moistened fingers was, however, known 100 years before Goldsmith's novel. It was to this instrument that Benjamin Franklin applied his improvements described in his letter to Father Beccaria of Turin. Instead of fixing the glasses he made them rotate round a spindle set in motion by the player's foot by means of a treadle. The edge of the glasses by the same means passed through a basin of water, the pitch henceforth being determined by the size of the glasses alone. The player touched the brims of the revolving glasses with his finger, his task being further facilitated by the scale of color which Franklin adopted in accordance with the musical gamut. The instrument thus improved became very fashionable in England, and a Miss Davis, a relation of Franklin's, became a celebrated harmonica player, who performed at numerous concerts with great applause. It is interesting to know that the great composer Gluck was a virtuoso on the musical glasses in their earlier form, which he played, according to a contemporary advertisement, at the Haymarket theater, April 23, 1746.

HARMONIC ANALYSIS is the name given by Sir William Thomson and Professor Tait in their treatise on *Natural Philosophy* to a general method of investigating physical questions, the earliest applications of which seem to have been suggested by the study of the vibrations of strings and the analysis of these vibrations into their fundamental tone and its harmonics or overtones.

The motion of a uniform stretched string fixed at both ends is a periodic motion; that is to say, after a certain interval of time, called the fundamental period of the motion, the form of the string and the velocity of every part of it are the same as before, provided that the energy of the motion has not been sensibly dissipated during the period.

There are two distinct methods of investigating the motion of a uniform stretched string. One of these may be called the wave method, and the other the harmonic method. The wave method is founded on the theorem that in a stretched string of infinite length a wave of any form may be propagated in either direction with a certain velocity, V , which we may define as the "velocity of propagation." If a wave of any form traveling in the positive direction meets another traveling in the opposite direction, the form of which is such that the lines joining corresponding points of the two waves are all bisected in a fixed point in the line of the string, then the point of the string corresponding to this point will remain fixed, while the two waves pass in opposite directions.

In the harmonic method, on the other hand, the motion of the string is regarded as compounded of a series of vibratory motions which may be infinite in number, but each of which is perfectly definite in type, and is in fact a particular solution of the problem of the motion of a string with its ends fixed.

HARMONIUM. Perhaps no musical instrument ever became in a few years so widely known and used as the harmonium. The reasons for this may at once be found in the facilities it offers for playing easy music, and, when simply constructed, its comparatively low price, which renders the purchase of a tolerable harmonium possible when the cheapest pianoforte worthy of the name would be unattainable, and the real organ, although of chamber size, quite out of the question. Besides being a convenient makeshift for an organ, the harmonium can also be used in domestic concerted music, to play all or any of the wind band parts of the orchestra; it may even be employed as a substitute for the violin, and in such vicarious uses it is past all question one of the handiest of deputies.

It is true the tone of the harmonium is not in itself beautiful; the prominence in sounds from reeds of certain overtones is irreconcilable with pleasure to the ear unless by convention of habit, and the necessity of tuning according to equal temperament all major thirds too sharp leads through this harmonic peculiarity in the chords to an abnormally disagreeable quality, from which those whose nerves are very sensitive or weak are not unfrequently painfully affected. The American organ, a kind of harmonium of late years much in vogue, owes its popularity to its being less pronounced and reedy in timbre (its softer tone being nearer to that we are familiar with in the church organ), and to its being easier to play for simple domestic use. Yet the real harmonium has more independent character as an instrument, and is capable of higher treatment in performance than the American organ.

Both are known as "free reed" instruments, the musical tones being produced by tongues of brass, technically "vibrators," set in oblong frames; the sides of these they do not quite touch, but pass, when in movement, freely downward—the "beating reeds" used in church organs covering the entire orifice. A reed or vibrator, set in periodic motion by impact of a current of air, produces a corresponding succession of air puffs, the rapidity of which determines the pitch of the musical note. There is an essential difference between the harmonium and the American organ in the direction of this current; in the former the wind apparatus forces the current upward, and in the latter sucks it downward.

The Harmonium has a keyboard of five octaves' compass when complete, from C to C, and a simple action controlling the valves, etc. The necessary pressure of wind is generated by bellows worked by the feet of the performer upon footboards or treadles. The air is thus

forced up the wind-trunks into an air chamber called the wind-chest, the pressure of it being equalized by a reservoir, which receives the excess of wind through an aperture, and permits escape, when above a certain pressure, by a discharge valve or pallet. The aperture admitting air to the reservoir may be closed by a draw-stop named "expression." The character of the instrument is then entirely changed from a mechanical response to the player's touch to an expressive one, rendering what emotion may be communicated from the player by increase or diminution of sound through the greater or less pressure of wind the reeds may be submitted to. The draw-stops bearing the names of the different registers in imitation of the organ, admit, when drawn, the wind from the wind-chest to the corresponding reed compartments, shutting them off when closed.

The American organ acts by wind exhaustion. A vacuum is practically created in the air-chamber by the exhausting power of the footboards, and a current of air thus drawn downward passes through any reeds that are left open, setting them in vibration. This instrument has, therefore, exhaust instead of force bellows. Valves in the board above the air-chamber give communication to reeds, made more slender than those of the harmonium, and more or less bent, while the frames in which they are fixed are also differently shaped, being hollowed rather in spoon fashion. The channels, the resonators above the reeds, are not varied in size or shape as in the harmonium; they exactly correspond with the reeds, and are collectively known as the "tube-board." The swell "fortes" are in front of the openings of these tubes, rails that open or close by the action of the knees upon what may be called knee pedals. The tone of the American organ is softer than that of the harmonium; this is sometimes aided by the use of extra resonators. The blowing being also easier, ladies find it much less fatiguing. To these differences we may attribute its increasing popularity. The expression stop can have little power in the American organ, and is generally absent; the "automatic swell" is a contrivance that comes the nearest to it, though far inferior. By it a swell shutter or rail is kept in constant movement, proportioned to the force of the air current. Another very clever improvement introduced by these makers, who are the originators of the instrument itself, is the "vox humana," a smaller rail or fan, made to revolve rapidly by wind pressure; its rotation, disturbing the air near the reeds, causes interferences of vibration that produce a tremulous effect, not unlike the beatings heard from combined voices, whence this name. This vibrato stop has found general adoption. The arrangement of reed compartments in American organs does not essentially differ from that of the harmoniums; but there are often two keyboards, and then the solo and combination stops are found on the upper manual. The diapason treble register is known as "melodia"—different makers occasionally vary the use of fancy names for other stops. The "subbass," however, an octave of sixteen feet pitch and always apart from the other reeds, is used with great advantage for pedal effects on the manual, the compass of American organs being usually down to F (FF, 5 octaves). In large instruments there are sometimes foot pedals as in an organ, with their own reed boxes of eight and sixteen feet, the lowest note being then CC. Blowing for pedal instruments has to be done by hand, a lever being attached for that purpose.

HARMONY. See ACOUSTICS and MUSIC.

HARO, said to be the ancient *Castrum Bilium*, a town of Spain, is situated in the province of Logroño, and the bishopric of Calahorra, twelve miles southeast of

Miranda, and fifty-eight miles north of Madrid. Population, about 8,000.

HAROLD I., surnamed Fairhaired (Harald Haar-fager), the founder of the old royal dynasty of Norway, succeeded his father, Halfdan the Black, as jarl about the year 863. His ambition to become king is said to have been awakened by the refusal of Gyda, daughter of Eric of Hadaland, to marry him until he had made himself ruler of all Norway, as Gorm had of Denmark, and Eric of Sweden; and he vowed that he would never clip nor comb his hair until he had fully achieved his task. After he had subdued all the jarls, he sent for Gyda and made her one of his wives, and had his hair cut at a feast in Möre by Jarl Rögnwald, who then gave him the name of *Haarfager*. Harold died about the year 933.

HAROLD II., surnamed Greyskin (Harald Graafel), son of Eric Bloodyaxe, succeeded Haco the Good in the government of Norway about the year 960, having bribed his other brothers to be satisfied with reigning as under kings in the other provinces. It would appear that Harold himself was disposed to govern peacefully and well, but his brothers now resolved to take vengeance on the friends of the late King Haco, and murdered among others Jarl Sigurd. They, however, failed of their purpose on Haco, his son, who after for some time resisting their attacks fled to Denmark, where he obtained the assistance of King Harold Bluetooth, with whose help he defeated and slew Harold Greyskin, upon which, under Harold Bluetooth, he became ruler of Norway with the title of jarl, according to some in the year 965, to others in 975.

HAROLD III., surnamed Stern in Council (Harald Haardraade or Hardrada), son of Jarl Sigurd, half-brother of King Olaf the Holy, and descended by his father from Harold I., was one of the most distinguished warriors among the old Norse kings. About the year 1045 he came to an agreement with his relative Swend of Denmark, who had been driven by Magnus into exile in Sweden; but Magnus, having obtained news of the intended joint expedition against him, entered into communication with Harold, and agreed to share with him the government of Norway, each ruling over a separate division. They now turned their united forces against Swend, drove him from Denmark, and completely prostrated his power; but just when he had resolved finally in despair to give up the contest, Magnus about the year 1047 took suddenly ill and died, bequeathing on his death-bed the whole of Norway to Harold and Denmark to Swend. Such a bequest did not, however, coincide with the desires of Harold, and between him and Swend a constant warfare raged for several years, until in 1064 they agreed to a peace by which each retained his dominions according to the old established boundaries. The chief motive of Harold in consenting to this arrangement was probably that he might be free to embark on a purpose of wider ambition, namely, to revive in his own person the old Scandinavian sovereignty of England which ended with the death of Hardicanute. In 1066 he set sail for England with an immense fleet. After touching at Orkney, where he left his wife, he proceeded southward to the Tyne, and was there joined by Tostig and by a contingent of troops from Malcolm of Scotland. Leaving a detachment under his son Olaf to guard the fleet, Harold along with Tostig marched with a great force toward York, and, defeating the Northumbrians with heavy loss at Fulford on September 20th, received the surrender of the city on September 24th. Meanwhile Harold of England, having heard of the Norse invasion, was marching northward from London day and night with an immense army; and passing through York on the day after its surrender, he appeared suddenly before the Norsemen encamped at

Stamfordbridge. The Norsemen fought with stubborn courage and fierce energy, but the battle ended at night-fall in their total overthrow. Tostig was slain and also Harold Hardrada himself.

HAROLD IV., king of Norway, surnamed Gille,—said to be the short form of Gylle Kirst, that is, Servant of Christ,—came about the year 1127 to Norway with his mother, an Irishwoman, and claimed to be recognized as the son of King Magnus Barefoot, and half-brother of the reigning Sigurd. Harold reigned as sole king till 1136, when he was murdered in his sleep by Slembi-diakn, another bastard son of Magnus Barefoot.

HAROLD I., surnamed Harefoot, king of England, illegitimate son of Canute and Alfgiva of Northampton, was on the death of Canute in 1035 chosen by the witan overlord of England and king of the province north of the Thames; and in 1037 he became king of England, when the people of Wessex offered him their crown on Hardicanute's refusal to come to England to accept it. In the beginning of Harold's reign Alfred, son of Ethelred, landed in Wessex, with the purpose, it is said, of asserting his claims to its sovereignty; but, either without the knowledge of Earl Godwine, or with his connivance, he was seized by the agents of Harold and put to death with cruel tortures. Harold also banished Queen Emma from the kingdom. The only other event of importance in his reign are inroads of the Welsh and Scots, which were, however, without effectual results, and in the case of the Scots who laid siege to Durham ended in defeat with heavy loss. Harold died at Oxford, March 10, 1040.

HAROLD II., king of the English, was the second son of Earl Godwine and his Danish wife Gytha, the sister of Earl Ulf. The year of his birth is not actually fixed, but it must have been about 1022. The choice of his name, like that of some others of his brothers and sisters (see GODWINE), witnesses to the influence of his Danish mother. Both he and his elder brother Swegen were appointed to earldoms while still very young, seemingly about 1045. Harold's earldom was that of the East-Angles. In 1046 Swegen, having carried off Eadgifu, abbess of Leominster, and not being allowed to marry her, threw up his earldom in disgust, and his possessions were divided between his brother Harold and his cousin Earl Beorn, the nephew of Gytha. In 1049 Swegen came back and sought the recovery of his lands, which was refused by Harold and Beorn. We next hear of Harold in 1051 as accompanying Godwine when he appeared in arms in Gloucestershire. He shared his father's outlawry and banishment in that year, but he chose a different place of shelter, going with his brother Leofwine to Ireland, while Godwine went to Flanders. In 1052 Harold and Leofwine came back. Harold was now restored to his earldom of the East-Angles, and, on his father's death in 1053, he succeeded him in the greater earldom of the West-Saxons. Harold was now the chief man in the kingdom, and when the older earls Leofric and Siward died, his power increased yet more, and the latter part of Eadward's reign was virtually the reign of Harold.

Of one very important event in Harold's life the date can only be guessed at. At some time or other between William's visit to England in 1051 and Eadward's death at the beginning of 1066, Harold was the guest of Duke William in Normandy, and took some kind of oath to him. This oath the Normans represented as an act of homage, with a further oath to procure William's succession to the English crown. The tale is told only by the Norman writers, and it is told by them with such contradictions of every kind that no reliance can be placed on any detail. But that there is some truth in the story is proved by the strongest negative evidence.

While the contemporary English writers take care, directly or indirectly, to deny all those Norman charges against Harold which were sheer invention, they say not a word as to his alleged oath to William. It seems on the whole most likely that Harold was wrecked on the shore of Ponthieu, imprisoned by its Count, Guy, and released by the interference of William. He then helped William in a war with the Bretons, and promised to marry one of his daughters. This was most likely accompanied by an act of homage, such as was often made to any superior or benefactor. Such an oath might, in the ideas of the times, be made to mean a great deal or very little, according to circumstances.

At the beginning of 1066 Eadward died. His last act was to recommend Harold for election to the crown. He was accordingly chosen on the day of Eadward's death, January 5th, and crowned the next day by Ealdred, archbishop of York. But, though he was crowned by the Northumbrian primate, the men of Northumberland at first refused to acknowledge him. They were won over by the new king, who went to York, accompanied by Saint Wulfstan, bishop of Worcester. To secure Eadwine and Morkere, he married their sister Ealdgyth, the widow of the Welsh king Gruffydd. He thus put it out of his power to comply with that part of his engagement to William which is best attested, namely, to marry one of William's daughters. The rest of Harold's reign was taken up with preparations against the attacks of two enemies at once. William challenged the crown, alleging both a bequest of Eadward in his favor and the personal engagement which Harold had contracted toward him. This was of course a mere matter of form, and William began to make ready for the invasion of England. Meanwhile the banished Tostig was trying all means to bring about his own restoration. He first, seemingly in concert with William, came in May, and attacked first the Isle of Wight and then Lindesey, but was driven to take shelter in Scotland. From May to September the king kept the coasts with a great force by sea and land; but at last provisions failed, and the land army was dispersed. Harold then went to London, ready to meet whichever enemy came first. By this time Tostig had engaged Harold Hardrada of Norway to invade England. He accordingly sailed up the Humber, defeated Eadwine and Morkere (September 20th), and received the submission of York (September 24th). Harold of England was now on his march northward; on September 25th he came on the Northmen at Stamfordbridge beyond York, and won a complete victory, in which Tostig and Harold Hardrada were slain. But two days later (September 27th) William of Normandy landed at Pevensey and (September 29th) occupied Hastings, and laid waste the land. Harold had then to march southward as fast as possible. He gathered his army in London from all southern and eastern England, but Eadwine and Morkere kept back the forces of the north. The king then marched into Sussex, occupied the hill of Senlac, now Battle, and awaited the Norman attack. After a vain exchange of messages, the decisive battle was fought on October 14th. As the English were wholly infantry, while the Normans were strongest in cavalry and archers, Harold's object was simply to hold the hill against all attack. As long as he was obeyed, his tactics were completely successful. But a part of his troops, disobeying his orders, left the hill to pursue, and the English array was broken. The Normans could now get up the hill, and, after a fight which lasted from morning till evening, they had the victory. The king and his brothers Gyrth and Leofwine were killed. As Harold was condemned by the pope, William at first refused him Christian burial, and caused him to be

buried on the rocks at Hastings. But it seems most likely that he afterward allowed the body to be removed to Harold's own church at Waltham. The tale which represents Harold as escaping from the battle, living a life of penitence, and at last dying at Chester, is a mere romance.

HAROUN AL RASCHID, more properly Harún er Rashíd, "Aaron the Orthodox," was the fifth of the 'Abbaside caliphs of Bagdad. He was born at Ray, March 20, 763 A.D., according to some accounts, and according to others February 15, 766 A.D. Haroun al Raschid was twenty-two years old when he ascended the throne. His biographers unanimously speak of him as "the most accomplished, eloquent, and generous of the caliphs;" but though his name is a household word, and few figures stand out more grandly prominent in the history of their times, little is really popularly known about his private life and personal history.

Raschid owed his own succession to the throne entirely to the prudence and sagacity of Yahya, his secretary, whom, on his accession, he appointed his lieutenant and grand vizier. Yahya, upon whom the whole responsibility of the government really devolved, performed his duties with the most consummate ability and judgment. He fortified the frontiers, and repaired all the deficiencies in the administration of the empire. He filled the treasury, made the provinces flourishing and prosperous by encouraging trade and securing the public safety, and in a word brought the caliphate up to the highest pitch of prosperity and glory.

In 182 A.H. (798 A.D.) Al Raschid proclaimed his son 'Abdallah as his heir apparent after El Amín, his eldest son, whom he had appointed his successor when only five years old, and gave him the post of viceroy of Khorassan. It was on this occasion that he gave 'Abdallah the name of El Mamún and confided him to the care of Jaafer, son of Yahya.

Yahya, the prime minister, and Jaafer, his son, enjoyed so fully the confidence of Haroun al Raschid that they rapidly rose to wealth and power. The great popularity and influence of the Barmek or Barmecide family, however, at length aroused the caliph's jealousy, and to make matters worse he heard that Jaafer had secretly married his sister. No sooner had he been made acquainted with the facts than he caused his sister to be put to death, ordered Mesrúr, his slave and executioner, to bring him Jaafer's head, and next murdered his two inoffending young nephews.

After the fall of the Barmek family the office of prime minister was exercised by Fadhl ibn Rabi, who had been chamberlain to Haroun himself, and to his predecessors Mensúr, Mehdi, and Hádi. He held the office of vizier until the death of Haroun al Raschid, which occurred at Tus, 909 A.D.

The reign of Al Raschid was one of the most brilliant in the annals of the caliphate, and the limits of the empire were then more widely extended than at any other period. The greater part of the Eastern world submitted to his laws, and paid tribute into his treasury; Egypt itself was only a province under his sway, and its ruler an officer appointed by himself. No caliph ever gathered round him so great a number of learned men, poets, jurists, grammarians, cadis, and scribes, to say nothing of the wits and musicians who enjoyed his patronage. Haroun himself was an accomplished scholar and an excellent poet.

Haroun al Raschid is best known to Western readers as the hero of many of the stories in the *Arabian Nights*; and in Arabic literature he is the central figure of numberless anecdotes and humorous stories. Of his incognito walks through Bagdad, however, the authentic histories say nothing; and the account of his

relations with Charlemagne, of which European historians speak, does not rest on a trustworthy basis.

HARP, a musical instrument of the string kind, approximating to triangular form from the strings diminishing in length as they ascend in pitch. While the instrument is of great antiquity, it is yet from northern Europe that the modern harp and its name are derived. The Greeks and Romans preferred to it the lyre in its different varieties, and a Latin writer, Fortunatus, describes it in the seventh century of our era as an instrument of the barbarians. This is believed to be the earliest mention of the name, which is clearly Teutonic—the Old High German "harapha," the Anglo-Saxon "hearpe," the Old Norse "harpa." For the origin of the instrument we have to look to Egypt, and the earliest delineations of it there give no indication that it had not existed long before. There are, indeed, representations in Egyptian paintings of stringed instruments of a bow-form that support the idea of the invention of the harp from the tense string of the warrior's or hunter's bow. This primitive-looking instrument was played horizontally, being borne upon the performer's shoulder. Between it and the grand vertical harps in the frescos of the time of Rameses III., more than 3,000 years old, paintings discovered by the traveler Bruce, there are varieties that permit us to bind the whole, from the simplest bow-form to the almost triangular harp, into one family.

The ancient Assyrians had harps like those of Egypt in being without a front pillar, but differing from them in having the sound-body uppermost, in which we find the early use of soundholes; while the lower portion was a bar to which the strings were tied, and by means of which the tuning was apparently effected. What the Hebrew harp was, whether it followed the Egyptian or the Assyrian, we do not know. That King David played upon the harp, as commonly depicted, is rather a modern idea. Mediæval artists frequently gave King David the psaltery, a horizontal stringed instrument from which has gradually developed the modern piano.

The earliest records that we possess of the Celtic race, whether Gaelic or Cymric, give the harp a prominent place, and harpists peculiar veneration and distinction. The names for the harp are, however, quite different from the Teutonic.

Turning to the modern harp, the first pattern of it is discovered in German and Anglo-Saxon illuminated MSS. as far back as the ninth century. A diatonic instrument, it must have been common throughout Europe, as Orcagna, Fra Angelico, and other famous Italian painters depict it over and over again in their masterpieces. No accidental semitones were possible with this instrument, unless the strings were shortened by the player's finger. This lasted until the seventeenth century, when a Tyrolese maker adopted hooks (perhaps suggested by the fretted or bonded clavichord) that, screwed into the neck, could be turned downward to fix the desired semitone at pleasure. At last, somewhere about 1720, Hochbrucker, a Bavarian, invented pedals that, acting through the pedestal of the instrument, governed by mechanism the stopping, and thus left the player's hands free, an indisputable advantage; and it became possible at once to play in no less than eight major scales. By a sequence of improvements, in which two Frenchmen, named Cousineau, took an important part, the various defects inherent in Hochbrucker's plan became ameliorated. The pedals were doubled, and, the tuning of the instrument being changed from the key of E flat to C flat, it became possible to play in fifteen keys, thus exceeding the power of the keyboard instruments, over which the harp has another advan-

tage in the simplicity of the fingering, which is the same for every key.

It is to Sebastian Erard we owe the perfecting of the pedal harp, a triumph he gained in Paris by unremitting studies, begun when he adopted a "fork" mechanism in 1786, and ended in 1810, when he had attained complete success. The mechanical perfection of Erard's apparatus must be seen to be appreciated. Notwithstanding these improvements, and the great beauty of tone the harp possesses, the domestic use of it has for years past been declining. The great cost of a good harp, and the trouble to many amateurs of tuning, may have led to the supplanting of the harp by the more convenient and useful pianoforte. With this comes naturally a diminution in the number of solo-players on the instrument. Were it not for the increasing use of the harp in the orchestra, the color of its tone having attracted the masters of instrumentation, so that the great scores of Meyerbeer and Gounod, of Berlioz, Liszt, and Wagner are not complete without it, we should perhaps know little more of the harp than the dulcimer, in spite of the efforts of distinguished virtuosi, whose devotion to their instrument maintains its technique on an equality with that of any other, even the most in public favor.

HARPER'S FERRY, a post village of Jefferson county, W. Va., is grandly situated at the foot of Bolivar heights and at the confluence of the Shenandoah and Potomac rivers, where they intersect the Blue Ridge, forty-five miles north-west of Washington. It is the junction-point of the Baltimore and Ohio and the Winchester and Potomac railways; and the Ohio and Chesapeake canal passes along the Maryland side of the Potomac river. The village since the civil war has been in a decaying condition. Previous to the war Harper's Ferry contained an extensive arsenal and armory, and during the war it was the scene of several exploits which have given it a name in history. On October 16, 1859, it was seized by John Brown, the celebrated abolitionist, and a small handful of followers, but as he was unsupported by a rising of the slaves he was overpowered on the morning of the 18th and taken prisoner. On April 18, 1861, it was captured by the Confederates, who on evacuating it in the following June destroyed the arsenal and armory and the bridge across the Potomac. The village was afterward held by a Union garrison of 12,000 men, who, however, on September 15, 1862, after a brave resistance of several days, surrendered to a strong Confederate force under Jackson and A. P. Hill. After the battle of Antietam, on the 17th of the same month, it was reoccupied by the army of the Potomac under General McClellan, who left a strong garrison in the place. In June, 1863, it was again abandoned to the Confederates on their march to Pennsylvania. After their defeat at Gettysburg, the town again fell into the hands of the Federal troops, who held it until the demonstration against Washington in July, 1864. After the battle of Monocacy on July 9th, it was occupied by the United States forces, and held by them until the end of the war. The most flourishing part of the town was nearly destroyed by a flood in the Shenandoah, October, 1878.

HARPIES, or HARPYIÆ, are in Homer merely the embodiment of the rapacious power of violent winds. When a man has disappeared in a sudden and inexplicable fashion, it is said that the Harpies have carried him off. There can be no doubt that the wind was by the primitive Indo-Germanic people considered to be the agent that carried off the souls of the dead to dwell with their fathers in heaven, and that this idea appears in the *Odyssey* in a more fanciful form.

HARPOCRATES, originally an Egyptian deity, was

adopted by the Greeks, and became in later times an object of worship both to Greeks and Romans. In Egypt Harpa-khruti, Horus the child, was one of the forms of Horus, the sun-god, the child of Osiris. Hence Herodotus considers him the same as the Greek Apollo. He was said by the Greeks to have been born with his finger on his lips, and is thus represented in statues. As the god of silence he became a favorite deity among the later mystic schools of philosophy. Festivals with certain mysterious rites were celebrated in his honor.

HARPY, a large diurnal bird of prey, so named after the mythological monster of the classical poets, an inhabitant of the warmer parts of America from Southern Mexico to Brazil. Though known for more than two centuries, its habits have come very little under the notice of naturalists, and what is said of it by the older writers must be received with some suspicion. A cursory inspection of the bird, its size, and its enormous bill and talons, at once suggest the vast powers of destruction imputed to it, and are enough to account for the stories told of its ravages on mammals—sloths, fawns, peccaries, and spider-monkeys. It has even been asserted to attack the human race. How much of this is fabulous there seem no means at present of determining, but some of the statements are made by veracious travelers—D'Orbigny and Tschudi. It is not uncommon in the forests of the isthmus of Panama, and Mr. Salvin says that its flight is slow and heavy. Indeed, its Owl-like visage, its short wings and soft plumage, do not indicate a bird of very active habits, but the weapons of offense with which, as above stated, it is armed, show that it must be able to cope with vigorous prey. Its appearance is sufficiently striking—the head and lower parts, except a pectoral band, white, the former adorned with an erectile crest, the upper parts dark gray banded with black, the wings dusky, and the tail barred; but the huge bill and powerful scutellated legs most of all impress the beholder.

HARRIER. See DOG.

HARRIER, or HEN-HARRIER, a name given to certain birds of prey which were formerly very abundant in parts of the British Islands, from their habit of harrying poultry. The first of these names has now become used in a generic sense for all the species ranked under the genus *Circus* of Lacépède, and the second confined to the particular species which is the *Falco cyaneus* of Linnæus and the *Circus cyaneus* of modern ornithologists.

On the wing Harriers have much resemblance to Buzzards, using the same flapping stroke of the pinions, and wheeling or sailing aloft as they fly. But Harriers are not, like Buzzards, arboreal in their habits, and always affect open country, generally, though not invariably, preferring marshy or fenny districts, for snakes and frogs form a great part of their ordinary food. On the ground their carriage is utterly unlike that of a Buzzard, and their long wings and legs render it easy to distinguish the two groups when taken in the hand. Harriers are found almost all over the world, and fifteen species are recognized by Mr. Sharpe.

HARRINGTON, JAMES, a distinguished writer on the philosophy of government, was sprung from an old family in Rutlandshire, and was born in 1611. He received a careful education, and in his eighteenth year entered Trinity college, Oxford, as a gentleman commoner. One of his tutors was the famous Chillingworth. At the close of his university career he set out to travel on the Continent, and proceeded first to Holland, where he spent several years. He served some time in the Dutch army, and enjoyed the friendship both of the prince of Orange and of the queen of Bohemia. After visiting France and Italy, he returned

to England and lived in retirement till 1646, when he was named one of the grooms of the bed-chamber to Charles I., who was at that time being conveyed south from Newcastle as prisoner of the parliament.

After Charles' death, Harrington once more withdrew into private life and devoted his time to the composition of his work on the theory of the state, afterward published under the title of *Oceana*. By order of Cromwell the *Oceana* was seized when passing through the press. Harrington, however, managed to secure the favor of the Protector's favorite daughter, Mrs. Claypole; the work was restored to him, and appeared in 1656, dedicated to Cromwell. The views embodied in *Oceana*, particularly that bearing on vote by ballot and rotation of magistrates and legislators, Harrington and others who formed a club called the "Rota" endeavored to push practically, but with no success. In December, 1661, by order of Charles II., Harrington was arrested on a charge of conspiracy, and was thrown into prison. Despite his repeated request no public trial could be obtained, and when at length he endeavored to protect himself by claiming the right of *habeas corpus*, he was secretly removed to a small island off Plymouth. There his health completely gave way, and his mind appeared to be affected. By careful treatment he was restored to bodily vigor, but it is supposed that his mind never recovered its tone. He died September 11, 1677.

HARRINGTON, SIR JOHN. See HARINGTON.

HARRIOT, or HARRIOTT, THOMAS, an English mathematician and astronomer, was born at Oxford in 1560. After studying at St. Mary's hall, Oxford, where he took his bachelor's degree in 1579, he became tutor to Sir Walter Raleigh, who in 1585 appointed him to the office of geographer to the second expedition to Virginia. Harriot published an account of this expedition in 1588, and the work was afterward reprinted in Hakluyt's *Voyages*. On his return to England after an absence of two years, he resumed his mathematical studies with zeal and success. He died at London, July 2, 1621.

HARRIS, JAMES (1709-1780), a distinguished English writer on the subject of grammar, was born at Salisbury, on July 20, 1709. In 1751 appeared the work by which he is best known, *Hermes*, a philosophical inquiry concerning universal grammar. The *Philological Inquiries* is a pleasantly written but slight work on the principles of literary criticism and style. It is the least pedantic of all his works. Harris died in December, 1780.

HARRIS, JOHN, D.D. (1667-1719), an English writer, best known as the editor of the *Lexicon Technicum*, which ranks as the earliest of the long line of English encyclopædias, and as the compiler of the *Collection of Voyages and Travels* which passes under his name.

HARRIS, JOHN, divine and theologian, was born at Ugborough, in Devonshire, March 8, 1802, and died in 1856.

HARRIS, SIR WILLIAM SNOW, a distinguished electrician, was born in Plymouth, April 1, 1791. As early as 1820 he had invented a new method of arranging the lightning conductors of ships; but it was only with great difficulty, and not till nearly thirty years afterward, that his invention was adopted by the government for the royal navy. In 1826 he read a paper before the Royal Society *On the Relative Powers of various Metallic Substances as Conductors of Electricity*, which led to his being elected a member of the society in 1831. Subsequently, in 1834, 1836, and 1839, he read before the society several valuable papers on the elementary laws of electricity, and he also communicated to the Royal Society of Edinburgh various inter-

esting accounts of his experiments and discoveries in the same field of inquiry. In 1835 he received the Copley gold medal from the Royal Society for his papers on the *Laws of Electricity by High Tension*, and in 1839 he was chosen to deliver the Bakerian lecture. His manuals of *Electricity*, *Galvanism* and *Magnetism* contributed to Weale's rudimentary series, were, however, written with great clearness, and passed through several editions. He died January 22, 1867, while having in preparation a *Treatise on Frictional Electricity*, which was published posthumously in the same year, with a memoir of the author by Charles Tomlinson, F.R.S.

HARRISBURG, a flourishing city, capital of Dauphin county and of the State of Pennsylvania, is beautifully situated on the east bank of the Susquehanna river, on the Pennsylvania canal, and at the junction of several railways, 126 miles by rail north of Washington and 105 west-by-north of Philadelphia. The river, which is here a mile in width, is crossed by two bridges, one of which is for the use of the railways. Two other bridges of great beauty and strength span the river in view of the State-house. The State buildings, dating from 1819, occupy an eminence in the center of the busiest portion of the city, and consist of the State capitol, 180 feet long by 80 feet wide, with a circular portico in front supported by six Ionic columns and surmounted by a dome, and, on two sides of the capitol, smaller buildings uniform in design, containing the executive chamber, the State treasury, and various other offices. The capitol park contains a monument to those who died in the Mexican war. Among the other public buildings are the county court-house, the State arsenal, the county prison, and the opera house. Harrisburg is a bishop's see of the Roman Catholic Church. It is well provided with academies and schools, and possesses about thirty churches, several of which are costly and ornamental edifices. It is also the seat of the State library of over 40,000 volumes. Among the benevolent institutions are the city hospital, the home for the friendless, and the State lunatic hospital. An abundant water supply is obtained from the river. Coal and iron are largely wrought in the neighborhood, and the great facilities of communication both by canal and railway have enabled the city to become one of the centers of the iron trade. It possesses large iron foundries, manufacturing of steel, machines, boilers, engines, carriages, nails, files, galvanized iron, brooms, soap, and shoes, rolling mills, saw and planing mills, flour mills, cotton mills, potteries, tanneries, and breweries. Harrisburg received its name from John Harris, an Englishman who settled on the site of the town in 1726, and whose son established a ferry over the Susquehanna in 1753. The town was founded in 1785 under the name of Harrisburg, which was afterward changed to Louisbourg; in 1791 it was incorporated under its present name; in 1812 it became the capital of the State; and in 1860 it was made a city. Population (1890), 39,385.

HARRISON, JOHN, an eminent mechanic, was born at Faulby, in Yorkshire, in 1693. The strong bent of his mind was toward mechanical pursuits; and this showed itself specially in endeavors to improve the construction of clocks and watches so as to render them more accurate measurers of time. He soon learned that, to enable a clock to keep accurate time, the pendulum must be so constructed as to preserve the distance between the point of suspension and center of oscillation invariable, notwithstanding the expansion and contraction of the rod caused by changes of temperature. To accomplish this Harrison devised, in 1726, his ingenious "gridiron pendulum," which consists in having the bob suspended by a series of parallel rods, alternately of steel and brass, so arranged that the downward ex-

pansion of the steel rods from change of temperature is exactly compensated for by the upward expansion of the brass rods. This principle of compensation, modified to suit particular cases, is now applied to all good watches and chronometers. Another ingenious improvement in clockmaking devised by Harrison was his recoil escapement, which obviated the necessity of keeping the pallets well oiled.

In Harrison's time the government of the country had become fully alive to the necessity of determining more accurately the longitude at sea. For this purpose they passed an Act in 1714 offering rewards of £10,000, £15,000, and £20,000 to any who should construct chronometers that would determine the longitude within sixty, forty, and thirty miles respectively. Harrison applied himself vigorously to the task, and in 1735 went to the Board of Longitude with a watch which he also showed to Halley, Graham, and others. Through their influence he was allowed to proceed in a king's ship to Lisbon to test it; and the result was so satisfactory that the commissioners gave him £500 to carry out further improvements. Harrison worked at the subject with the utmost perseverance, and, after making several watches, went up to London in 1761 with one which he considered very perfect. His son William was sent on a voyage to Jamaica to test it; and, on his return to Portsmouth in 1762, the watch was found to have lost only one minute, fifty-four and one-half seconds. This was surprisingly accurate, as it determined the longitude within eighteen miles, and Harrison claimed the full reward of £20,000. After some further trials £10,000 of it was paid to him in 1765, and the remainder in 1767, after he had written such a description of his instrument as would enable other artists to copy it. He died in 1776, at the age of eighty-two.

HARRISON, WILLIAM HENRY, ninth president of the United States, third son of Gov. Benjamin Harrison, was born at Berkeley, Charles City county, Va., February 9, 1773. In 1792 he joined the army with the commission of ensign, and in the following year became lieutenant and acted as aid-de-camp to Wayne in his expedition against the western Indians. He was promoted to a captaincy in 1795, but resigned in 1797 on being appointed Secretary of the Northwest Territory. In 1799 he was chosen to represent that territory in congress, and after its division in 1801 he became governor of the new territory of Indiana, and superintendent of negotiations with the Indians, over whom, on the breaking out of hostilities in 1811, he gained the important victory of Tippecanoe. In 1813 as major-general and commander of the northwestern army he defeated the British forces at the battle of the Thames. In 1814 he concluded a treaty with the northwestern Indians, and in the same year he resigned his commission. He was elected in 1816 member of congress for Cincinnati, in 1819 member of the State Senate of Ohio, in 1824 United States senator, and in 1828 became minister to Colombia, an office which he held for less than a year, when he retired for a time into private life. By the urgent request of the Whigs he was induced in 1836 to stand for the presidency of the United States, and though unsuccessful, he, at the next election in 1840 defeated the same candidate, Van Buren, by an overwhelming majority, after a canvass memorable for the extraordinary enthusiasm it awakened, and historically important for its introduction of new political methods—many of the most characteristic features of Western elections having their origin in this "Harrison campaign." He was scarcely spared, however, to enter upon the discharge of his duties of president, dying April 4, 1841, about a month after his inauguration.

HARRISON, a New Jersey town, in Hudson county, with a population (1890) of 8,338. The place

is sometimes called East Newark, but Harrison is its official designation. It has railroad, banking, telegraph facilities, and several higher educational institutions. Some manufactures exist here, principally trunks, thread, wire, cloth, etc.

HARROGATE, a town and watering-place in the West Riding of Yorkshire, England, is beautifully situated on a fine plateau near the River Nidd, eighteen miles west of York. It is indebted for its rise and importance to its medicinal springs, and is the principal inland watering-place in the north of England. Resident population about 8,000; doubled in the season by visitors.

HARROW-ON-THE-HILL, a village of Middlesex, England, ten miles northwest of London, derives the latter part of its name from its position on a hill which rises from the surrounding plain to the height of about 200 feet. On the summit, and forming a conspicuous landmark, is the church of St. Mary, said to have been founded by Lanfranc, archbishop of Canterbury, in the reign of William I., but of the original building very little is now left. Harrow is chiefly celebrated for its school, founded in 1571 by John Lyon, a yeoman of the neighboring village of Sudbury, who had yearly during his life set aside twenty marks for the education of poor children of Harrow. Though the charter was granted by Queen Elizabeth in 1571, and the statutes drawn up by the founder in 1590, two years before his death; it was not till 1611 that the first building was opened for scholars. Lyon originally settled about two-thirds of his property on the school, leaving the remainder for the maintenance of the highway between London and Harrow, but in the course of time the values of the respective endowments have changed, and while the road commissioners receive about £3,500, the school's share is only about £1,600. In 1660 the headmaster, taking advantage of a concession in Lyon's statutes, began to receive "foreigners," *i.e.*, boys from other parishes, who were to pay for their education. From this time the prosperity of the school may be dated. In 1809 the parishioners of Harrow appealed to the Court of Chancery against the manner in which the school was conducted, but the decision, while it recognized their privileges, confirmed the right of admission to foreigners. At present foundationers receive their education at a slightly cheaper rate than foreigners; there are none who are taught gratis. There is a considerable number of fellowships and scholarships in connection with the school to both the great English universities, some to special colleges, others to colleges in the choice of the holders. The general mode of instruction and discipline is modeled on that of Eton, where most of the former headmasters of Harrow were educated. Originally an exclusively classical school, mathematics became in 1837 a compulsory study at Harrow; modern languages, compulsory on the upper forms only since 1851, were extended to the whole school in 1855; while English history and literature began to be more especially studied about 1869. Science, music, and drawing are now also taught. Among the famous men who have been educated here may be mentioned Bruce, the Abyssinian traveler; Sir William Jones, the Orientalist, Doctor Parr, who was born at Harrow, Admiral Rodney, Sheridan, Byron, Peel, Theodore Hook, Lord Palmerston, Lord Herbert of Lea, the earl of Shaftesbury, and Archbishop Trench.

HARRY, BLIND, or HENRY THE MINSTREL, author of a poem in twelve books, entitled *The Actis and Deidis of the illuster and valzeand campioun, Schir William Wallace, Knicht of Ellerslie*. All that is known of Henry's personal history is contained in the following quotation from Major: "Henry, who was blind from

his birth, composed in the time of my youth the whole book of William Wallace, and embodied all the traditions about him in the ordinary measure, in which he was well skilled. By the recitation of these in the presence of the great, he procured, as indeed he deserved, food and clothing."

HARTE-BEEST (*Alcelaphus caama*), a species of antelope, occurring in considerable numbers throughout southern and central Africa. It stands nearly five feet high at the shoulders, and is somewhat ungainly in form, owing to the disproportionate development of its fore and hind quarters—a difference which gives to the posterior limbs, when in motion, an appearance of weakness. The head is long and narrow, and is crowned in both sexes by a pair of nearly cylindrical horns, ringed throughout their lower half, and smooth above. The hair of this species is short, soft, and recumbent, and is of a brownish-yellow color above, and nearly white beneath, the color, however, being to some extent dependent on age and sex, and on the season of the year. The harte-beest is gregarious, living in herds of from five to ten individuals, and frequenting tracts of uninhabited wilderness, or the light brush forest in the neighborhood of rivers. It is exceedingly wary, and consequently difficult of approach, and, when suddenly come upon, the entire herd scampers off in the train of a leader—the herd being rarely seen, when in flight, otherwise than in a string, one treading in the footsteps of another. Of a mild and gentle disposition, the harte-beest seeks safety, whenever it can, in flight; when at bay, however, it does not hesitate to turn upon its pursuers, and to make use of its powerful horns as weapons of offense.

HARTFORD, a Connecticut city, the capital of the State, and the county seat of Hartford county, lies on the Connecticut river, sixty miles from its mouth. It has numerous railway connections, and is in the main a very handsome city. It occupies a hilly site, the surface of which is somewhat uneven and irregular. The streets are straight and usually wide, and contain many handsome buildings. The most prominent public building is the State-house (white marble), situated in Bushnell Park. There are besides many handsome banking and insurance offices. So numerous are the insurance companies, that Hartford is the home *par excellence* of insurance. The new Trinity college is also an exceptionally fine structure. The other noted structures are the State arsenal, the high-school, the new postoffice and the United States court-house. Among the prominent educational establishments, other than those already mentioned, is the Connecticut theological institute. There are several fine libraries in the city, among which may be mentioned the Hartford library, the Wadsworth athenæum, the Watkinson library and the State library. The charities are worthily represented by the State asylum for deaf mutes, orphan asylum, insane asylum and a large hospital. The city has an extensive wholesale and retail trade. It is a great book publishing center and the principal tobacco market of the New England States. Numerous manufactures are carried on here, the principal articles of production being fire-arms of various kinds, machinery of all sorts, carriage goods, sash, doors, blinds, etc.

Hartford was first settled in 1633, and it was made the sole capital of the State in 1873. Before this date New Haven had divided this honor with the city. It takes its present name from Hartford in England. It was called New Town by the Dutch, who were its first settlers, but the English occupied it two years later, and in 1637 changed its name to the present one of Hartford. The city charter was obtained in 1784. Since 1830 the population, which was at that time about

7,000, has rapidly increased, and at present (1890) numbers 53,230.

HARTFORD CONVENTION, THE, was an assemblage of delegates from the New England States, at Hartford, Conn., December 15, 1814. It sat twenty days with closed doors, and as it was supposed to be of a treasonable character, it was watched by a military officer. The convention proposed certain amendments to the constitution; but though no treasonable act was committed, and no treasonable intention proved, the Federalist party never recovered from the odium of its opposition to the government, and "Hartford Convention Federalists" was long a term of reproach.

HARTIG, GEORG LUDWIG, a German writer on forestry, was born at Gladenbach near Marburg, September 2, 1764, and died at Berlin February 2, 1836.

HARTLEPOOL, and **WEST HARTLEPOOL**, respectively a municipal borough and a town of England, county of Durham and included in the parliamentary borough of the Hartlepoons, are situated, the one on the north and the other on the south side of Hartlepool Bay, about a mile apart, but having connection by railway, and practically forming portions of one town. By railway Hartlepool is ten miles and West Hartlepool twelve miles north-northeast of Stockton-on-Tees.

HARTLEY, DAVID, who may justly be called the founder of the English Association school of psychologists, was born in 1705. His university career so far modified his theological opinions that, feeling himself no longer able conscientiously to sign the Thirty-nine Articles, he abandoned his intention of studying for the ministry and devoted himself to the study of medicine. He, however, remained in the communion of the English Church, living on intimate terms with the most distinguished churchmen of his day, among whom may be named Joseph Butler, Warburton, Law, Hoadley, and the poet Young. Indeed he asserted it to be a duty to obey ecclesiastical as well as civil authorities. The doctrine to which he most strongly objected was that of eternal punishment. His keen interest in theology is proved by the fact that he devoted a large part of his *Observations* to that subject, the objective side of which he treated upon orthodox lines. The life of Hartley was the useful life of a benevolent and studious physician. He practiced at Newark, Bury St. Edmunds, London, and lastly at Bath, where he died on August 28, 1757. It was at the age of twenty-five that he commenced the series of essays that was to make up his *Observations on Man: his Frame, his Duty, and his Expectations*.

HARTLIB, SAMUEL, was born toward the beginning of the seventeenth century at Elbing in Prussia, his father being a refugee from Poland. His mother was English. About 1628 Hartlib went to England, where he carried on a mercantile agency, and at the same time found leisure to enter with interest into the public questions of the day. In 1641 appeared his *Relation of that which hath been lately attempted to procure Ecclesiastical Peace among Protestants*, and *A Description of Macaria*, containing his ideas of what a model state should be. During the civil war Hartlib occupied himself with the peaceful study of agriculture, printing at his own expense several treatises by others on the subject. In 1650 he issued the *Discourse of Flanders Husbandry* by Sir Richard Weston; and in 1651 his *Legacy, or an Enlargement of the Discourse of Husbandry used in Brabant and Flanders*, by Robert Child.

Hartlib received from Cromwell a pension of £100, afterward increased to £300, as he had spent all his fortune on his experiments. He planned a school for the sons of gentlemen, to be conducted on new prin-

ciples, and this probably was the occasion of his friend Milton's *Tractate on Education*, addressed to him in 1644, and of Sir William Petty's *Two Letters* on the same subject, in 1647 and 1648. His own literary labors were mostly confined to prefaces and short essays. The date of his death has been assigned to 1662, as the latest of his extant letters bears that date.

HARTMANN, MORITZ (1821-1872), a German poet and novelist, was born of Jewish parents at Duschnik in Bohemia, October 15, 1821. He studied at Prague and Vienna, and after a tour in Italy, Switzerland, and South Germany became a teacher in Vienna. He left Austria, however, in 1844, in order to publish without danger a volume of patriotic poems entitled *Kelch und Schwert*, which appeared at Leipsic in 1845. After residing for some years in Belgium and France, he went to Leipsic, where in 1847 he published *Neuere Gedichte*. Returning to Austria he suffered a short imprisonment, from which he was freed by the revolution of the following March. In the same year he was chosen to represent the district of Leitmeritz in the Frankfort parliament, where he took his seat on the extreme left. In October he accompanied Blum and Fröbel to Vienna, but he made his escape before the execution of Blum, and took part in the deliberations of the "Rump Parliament" at Stuttgart. In 1849 he published the *Reimchronik des Pfaffen Maurizius*, a satirical political poem in the style of the old chronicles. After the dissolution of the "Rump Parliament," he went to Switzerland, then to England and Ireland, and in 1850 to Paris. After several years' residence at Paris he settled in 1860 at Ghent, where he delivered courses of lectures on German literature and history in some of the principal academies. In 1863 he removed to Stuttgart to edit the *Freya*, and in 1868 he undertook the editorship at Vienna of the *Neue Freie Presse*. He died near Vienna, May 13, 1872.

HARTMANN VON AUE, a Middle High German poet, was born about 1170. He was of knightly rank, and was able to read and write. Among his accomplishments was a knowledge of French. Although his lyrics are not without merit he excels chiefly in narrative poetry; and the best known of his narrative poems, which was also one of the earliest, is *Der arme Heinrich* ("Poor Henry").

HARTSHORN, SPIRITS OF, a name signifying originally the ammoniacal liquor obtained by the distillation of horn shavings, afterward applied to the partially purified similar products of the action of heat on nitrogenous animal matter generally, and now popularly used to designate solution of ammonia. (See AMMONIA).

HARUN ER RASHID. See HAROUN AL RASCHID.

HARUSPICES (literally entrail-observers), a class of soothsayers in Rome. Their art consisted especially in deducing from the appearance presented by the entrails of the slain victim the will of the gods. They also interpreted all portents or unusual phenomena of nature, especially thunder and lightning, and prescribed the expiatory ceremonies after such events.

HARVARD COLLEGE, the earliest institution of learning in the United States and on the continent of North America. The English colonists on Massachusetts Bay, settling at what is now Boston in 1630, began a plantation the next year three miles up the Charles River, which they called "New Towne." The colony court of September, 1636, "agreed to give £400," which exactly doubled the public tax for the year, "towards a schoole or colledge, whereof £200 to be paid the next yeare, and £200 when the work is finished, and the next court to appoint wheare and what building." In November, 1637, "the Colledge is ordered to

be at New Towne," the name of which had been changed to Cambridge, and a committee was appointed "to take order" for it. In March, 1638-39, "it is ordered that the colledge agreed upon formerly to bee built at Cambridge shalbee called Harvard Colledge." The reason was that the Rev. John Harvard, B.A. 1632, and M.A. 1635, of Emmanuel College, Cambridge, England, dying in Charlestown, Mass., September 14, 1638, by will left half his estate, about £800, and his library, to the wilderness seminary. The college charter of 1650 declared the object to be "the education of the English and Indian youth of this country in knowledge and godlynes." The first brick edifice on the college grounds, having rooms for twenty of the aborigines, was called "the Indian college." In it was printed the apostle Eliot's translation of the Bible into the language of the natives, with primers, grammars, tracts, etc. Several of the natives were members of the college; only one graduated from it.

Thus from the beginning private munificence rather than the public treasury fostered and sustained the college, and with steadily increasing preponderance all through its history have its supplies and endowments come from the generosity of individuals. Grants from the colony, province, and State, of small sums for salaries and incidental purposes, made annually or at intervals, wholly ceased more than sixty years ago. With scarce an exception all the present invested funds of the college and of its professional schools, amounting to \$3,615,538.87, with the halls, library, and apparatus, are the benefactions of its friends.

The charter constitutes as a corporation a president, treasurer, and five fellows, who initiate all measures concerning the college, hold its funds, and have the nomination for filling vacancies in their own body, subject, however, to the final action of a board of overseers. The State, claiming as founder and patron, till recently regarded the college as a State institution, over which it should exercise a direct control through the legislature and the executive, by its authority in the membership and the election of the whole or a part of the board of overseers, but the organic connection with the State by this tie was severed by statute in 1866. The board of overseers as now constituted is composed of thirty of the alumni, besides the president and the treasurer, elected by the ballots of the alumni on commencement day at the college, in sections of five, serving a term of six years. With its complement of professional schools of law, medicine, theology, science, and many special departments of the latter, more than any other institution in America, and with but a few gaps yet to be filled in its completeness of method and equipment to bring it to comparison with foreign institutions of learning, Harvard College may claim to be in the most comprehensive sense of the term a university, a title which is, indeed, assumed, and generally applied to it. Recent changes in the course of study in the college have allowed a wide range for elective studies to undergraduates, the proportions being, one-fourth obligatory, three-fourths elective. In the professional schools most of the studies are obligatory. The number of bound volumes in the library and schools is 232,200. The number of halls owned and occupied for college uses is twenty-nine of brick or stone, including ten for students' chambers. The whole number of professors, instructors, etc., in all departments, is 135; of librarians, proctors, and other officers in the service of the college, twenty-eight. The number of the alumni of the college proper is about 9,600; the number in all departments about 14,000.

HARVEST-BUG, a name erroneously applied to the hexapod larval condition of a mite, not one of the

Insecta, but belonging to the division *Acaridea* of the class *Arachnida*. It is very small, of brick-red color, and swarms both among wild vegetation and cultivated plants, especially near the sea, attaching itself, however, on the first opportunity to the bodies of human beings, hares, dogs, cats, and other mammals, and even insects. On reaching the skin, it rapidly burrows deeply into it, causing a painful itching, followed by a swelling of irritation and size varying with the individuals attacked, and enduring for several days. It is usually at the end of July or in August that these mites make their appearance; and the frequency with which they attach themselves to the lower extremities of people walking in fields at harvest-time has given rise to their trivial name. The effect of their subcutaneous presence varies in different people, as above mentioned; in some it assumes so intensely painful an aspect as to originate a disease called autumnal erythema. Extraction with a fine needle, under a magnifying power, is the best way to get rid of the pests; but the application of a solution of carbolic acid, benzine, sulphur ointment, or any other powerful and easily diffused insecticide agent will usually soon destroy them.

HARVEY, GABRIEL (1545-1630), an English writer of the Elizabethan period, received his education at Christ's College and Pembroke Hall, Cambridge, where we find him about 1576-78 lecturing on rhetoric. Though Harvey expresses a desire to be "epitaphed the Inventor of the English Hexameter," his name, familiar enough to his more learned contemporaries, would probably have been well nigh forgotten had it not been for his friendship with Spenser and his hostilities with Greene and Nash.

HARVEY, SIR GEORGE, a Scottish painter and president of the Royal Scottish Academy, was born near Stirling in 1806. In his eighteenth year he entered the Trustees' Academy at Edinburgh. Here he so distinguished himself that in 1826 he was invited by the Scottish artists, who had resolved to found a Scottish academy, to join it as an associate. Harvey's first picture, *A Village School* was exhibited in 1826 at the Edinburgh Institution; and he continued annually to enrich its exhibitions by a succession of pictures, which appealed with such effect to Scottish sentiment as to win for him in his native land an unrivaled popularity. His best known pictures are those depicting historical episodes in religious history from a puritan or evangelical point of view, such as *Covenanters Preaching*, *Covenanters' Communion*, *John Bunyan and his Blind Daughter*, *Sabbath Evening*, and the *Quitting of the Manse*. He was equally successful in subjects not directly religious; and *The Bowlers*, *A Highland Funeral*, *The Curlers*, *A Schule Skailin'* and *Children Blowing Bubbles in the Churchyard of Greyfriars, Edinburgh*, manifest the same close observation of character, artistic conception, and conscientious elaboration of details. In *The Night Mail* and *Dawn Revealing the New World to Columbus* the aspects of nature are made use of in different ways, but with equal happiness, to lend impressiveness and solemnity to human concerns. In 1829 Harvey was elected a fellow of the Royal Scottish Academy, and in 1864 he succeeded Sir J. W. Gordon as president. He received the honor of knighthood in 1867. His death took place at Edinburgh, January 22, 1876.

HARVEY, WILLIAM, the discoverer of the circulation of the blood, was born at Folkestone in 1578. After passing through the grammar school of Canterbury, he became a pensioner of Caius College, Cambridge; at nineteen he took his B.A. degree, and soon after, having chosen the profession of medicine, he went to study at Padua under Fabricius and Casserius. At the age of twenty-four Harvey became doctor of medicine,

April, 1602. Returning to England in the first year of James I., he settled in London. In the same year Harvey became a candidate of the Royal College of Physicians, and was duly admitted a fellow. In 1609 he obtained the reversion of the post of physician to St. Bartholomew's hospital. On the death of Doctor Wilkinson in the course of the same year he succeeded to the post. He was thrice censor of the college, and in 1615 was appointed Lumleian lecturer. In the following year—the year of Shakespeare's death—he began his course of lectures, and first brought forward his views upon the movements of the heart and blood. In 1618 he was appointed physician extraordinary to James I., and on the next vacancy physician in ordinary to his successor. In 1628, the year of the publication of the *Exercitatio Anatomica de Motu Cordis et Sanguinis*, he was elected treasurer of the College of Physicians. He visited Italy, and returned in 1632. Four years later he accompanied the earl of Arundel on his embassy to the emperor. Having returned to his practice in London at the close of the year 1636, he accompanied Charles I. in one of his journeys to Scotland. While at Edinburgh he visited the Bass Rock; he minutely describes its abundant population of sea-fowl in his treatise *De Generatione*, and incidentally speaks of the then credited account of the solan goose growing on trees as a fable. He was in attendance on the king at the battle of Edgehill (October, 1642). After the indecisive battle, Harvey followed Charles I. to Oxford. There he remained three years, and there was some chance of his being superseded in his office at St. Bartholomew's Hospital, "because he had withdrawn himself from his charge, and is retired to the party in arms against the parliament." It was no doubt at this time that his lodgings at Whitehall were searched, and not only the furniture seized but also invaluable manuscripts and anatomical preparations.

While with the king at Oxford he was made warden of Merton College, but a year later, in 1646, that city surrendered to Fairfax, and Harvey returned to London. He was now sixty-eight years old, and, having resigned his appointments and relinquished the cares of practice, lived in learned retirement with one or other of his brothers. The work on which he had been chiefly engaged at Oxford, and indeed since the publication of his treatise on the circulation in 1628, was an investigation into the recondite but deeply interesting subject of generation. The result was the publication of the *Exercitationes de Generatione* (1651).

This was the last of Harvey's labors. He had now reached his seventy-third year. His theory of the circulation had been opposed and defended, and was now generally accepted by the most eminent anatomists both at home and abroad. He was known and honored throughout Europe, and his own college erected a statue in his honor (1652). In 1654 he was elected to the highest post in his profession, that of president of the college.

Harvey, like his great contemporary and successor Sydenham, was long afflicted with gout, but he preserved his activity of mind to an advanced age. In his eightieth year, on June 3, 1657, he was attacked by paralysis, and died the same evening.

HARWICH, a municipal and parliamentary borough and seaport town of Essex, England, is situated on the extremity of a small peninsula projecting into the estuary of the Stour and Orwell, seventy miles northeast of London. Harwich in all probability occupies the site of a Roman station. In 855 a great naval battle took place opposite the town between the Danes and the fleet of King Alfred, and in 1666 another took place between the Dutch and the English. Harwich

was created a parliamentary borough by King Edward II. in 1318 with the privilege of returning two members, but since the Reform Act of 1867 it has returned only one. Population (1890), 7,500.

HARZ MOUNTAINS, **THE** (also spelt **HARTZ**, the German *Harzgebirge*, and the ancient *Silva Hercynia*), the most northerly mountain-system of Germany, situated between the rivers Weser and Elbe, occupy an area of about 786 square miles, of which 457 belong to Prussia, 286 to Brunswick, and 43 to Anhalt. Their greatest length extends in a southeast and northwest direction for about fifty-six miles, and their maximum breadth is about twenty miles. The group is made up of an irregular series of terraced plateaus, rising here and there into rounded summits, and intersected in various directions by narrow, deep valleys. The highest summits of the Upper Harz are the Brocken (3,743 feet), the Heinrichshöhe (3,402 feet), the Greater and Less Königsberg (3,376 feet and 3,369 feet), and the Wormberg (3,182 feet); the Lower Harz, the Auersberg (1,870 feet), and the Victorshöhe (1,762 feet). The towns in the district, though not large, are tolerably numerous.

The chief industry is mining, which has been carried on since the middle of the tenth century. The Harz is second only to the Erzgebirge among the mountains of Germany in mineral wealth. The most important mineral is a peculiarly rich argentiferous lead, but gold in small quantities, copper, iron, sulphur, alum, and arsenic are also found. Marble, granite, and gypsum are worked; and large quantities of vitriol are manufactured. The vast forests that cover the mountain slopes supply the materials for a very considerable trade in timber.

The Harz being the first obstacle to oppose the moist, cold winds from the North Sea, the northern summits are destitute of trees, but the lower slopes of the Upper Harz are heavily wooded with pines and firs. Between the forests of these stretch numerous peat-mosses, which contain in their spongy reservoirs the sources of many small streams.

The inhabitants, about 70,000 in number, are descended from various stocks. The Upper and Lower Saxon, the Thuringian, and the Frankish races have all contributed to form the present people, and their respective influences are still to be traced in the varieties of dialect. The boundary line between High and Low German passes through the Harz.

The Harz is now one of the most frequented tourist resorts of Germany. It is traversed by excellent roads in all directions, and is completely girt by railways from the principal towns of the empire. The chief point of interest is undoubtedly the Brocken or Blocksberg, famous as the scene of the "Walpurgisnacht" in Goethe's *Faust*, as well as for the atmospherical phenomena of which the "spectre of the Brocken" (see **HALO**) is the best known. The Harz was the last stronghold of paganism in Germany, and to that fact are due the weird legends, in which no district is richer, and the wild and fanciful names that are given by the people to the peculiar objects and appearances of nature.

HARZBURG, or **NEUSTADT-HARZBURG**, the chief town in the Brunswick circle of Wolfenbüttel, Prussia, is situated 727 feet above sea-level on the right bank of the Radau. Population about 5,000.

HASAN AND HUSEIN, the sons of 'Alí ibn Abu Tálib, cousin and son-in-law of Mahomet, and heroes of the passion play performed annually throughout India and Persia by Shiah Mahometans in the month of Moharram.

HASBEYA, or **HASBEIYA**, a town of the Druses,

about thirty-six miles west of Damacus, is situated at the foot of Mount Hermon in Syria, overlooking a deep amphitheater, from which a brook flows to the Hasbâni. Population about 5,000.

HASDRUBAL. Of the bearers of this very common Carthaginian name the most famous are the following:—

1. One of the leaders of the popular party at the close of the first Punic war. He was conspicuous for his dexterous management in politics and his conciliatory manners. He married the daughter of Hamilcar Barca; and his skillful and cordial coöperation was of enormous consequence to Hamilcar during his Spanish wars. In 221 B.C. he fell by the hand of an assassin.

2. The second son of the great Hamilcar. He was left by Hannibal as commander in Spain (219 B.C.), where he had to contend with the two Scipios, Cneius and Publius. Three years were spent in desultory warfare, in which the Romans were generally successful. After the battle of Cannæ, Hasdrubal was ordered to march into Italy, while Himilco was sent from Carthage with a fresh army to supply his place. But a decisive battle on the Ebro, in which he was totally defeated, checked his northward march. It is hardly possible to exaggerate the importance of this battle. Had a fresh Carthaginian army joined Hannibal in Italy for the campaign of 215 or 214, the danger to Rome would have been infinitely increased. In 207 B.C., Hasdrubal, after a very rapid and skillful march across the whole breadth of Gaul, appeared in the north of Italy. When once he had succeeded in getting out of Spain, this brilliant march proved Hasdrubal worthy of his father and his brother. On hearing of the passage of the Pyrenees, the Romans raised extraordinary levies, but before they had taken any steps to meet him, Hasdrubal was already in Cisalpine Gaul. Hannibal was still in Apulia, perhaps not expecting his brother so soon; Hasdrubal sent to meet him two Numidian horsemen with four Gauls, who almost at the end of their perilous journey fell into the hands of the consul Nero. In the meantime Hasdrubal had advanced into Umbria, where the plebeian consul Livius was encamped near Siena. Nero, with 7,000 men, left his own camp, and by a rapid march, which must be ranked among the most important events of the war, joined his colleague. The united army was much too strong for Hasdrubal. He tried to avoid a battle, but his guides failed him, and he was forced to fight on the south bank of the Metaurus. A long and bloody conflict resulted in the complete defeat of the Carthaginians, and Hasdrubal, after all was lost, fell sword in hand in the midst of the enemy. His head, which was thrown by Nero's soldiers into Hannibal's camp, first revealed to the latter his brother's defeat and the ruin of the Carthaginian cause.

HASLINGDEN, a market town of Lancashire, England, is situated seven miles southeast of Blackburn, in a hilly district on the borders of the forest of Rossendale, and is supposed by some to derive its name from the hazel trees which at one time abounded in its neighborhood. Population (1890), 12,500.

HASPE, a town of Prussia, province of Westphalia. Population, 9,000.

HASSAN, a district of Mysore, India, bounded on the southwest by the Madras district of South Kanara, and on the south partly by the state of Coorg. The main portion of the district consists of the river basin of the Hemavati and its tributaries. It naturally divides into two portions, the Malnád or hill country, which includes some of the highest ranges of the Western Ghâts, and the Maidán or plain country, sloping toward the south. Area, 3,291 square miles. Population, 750,000.

HASSAN. See ASSASSINS.

HASSE, JOHANN ADOLPH. One of the most prolific and most celebrated composers of the eighteenth century, is now all but forgotten, and his extant works rest quietly on the shelves of public libraries. He was born at Bergedorf, near Hamburg, in 1699, and died in 1783.

HASSELQUIST, FREDERICK, a Swedish traveler and naturalist, was born near Linköping in East Gothland, January 3, 1722, and died in 1752.

HASSELT, a town of Belgium, capital of the province of Limburg, is situated on the Demer and on the railway from Aix-la-Chapelle to Maestricht, twenty miles northwest of Liège. Population, 12,000.

HASSENPFUG, HANS DANIEL LUDWIG FRIEDRICH, a minister of state in Hesse-Cassel, celebrated as a reactionary, was born at Hanau, in the electorate of Hesse, in 1793, and died in 1862.

HASTINAPUR, an ancient city of India, in the Meerut district, Northwestern Provinces, lying on the bank of the Burigangá, or former bed of the Ganges, twenty-two miles northeast of Meerut. It formed the capital of the great Pándava kingdom, celebrated in the *Mahábárata*, and probably one of the earliest Aryan settlements outside the Punjab.

HASTINGS, a municipal and parliamentary borough and market-town of Sussex, England, the principal of the Cinque Ports, is picturesquely situated on the southern coast of England, seventy-four miles from London. The area of the municipal borough is 1,636 acres, and of the parliamentary borough 4,617 acres. The population is about 35,000.

Hastings is of great antiquity, and was a place of some importance in the time of the Anglo-Saxons. Like the other principal seaports on the southern coast, it was garrisoned by Harold in view of the possible landing of William the Conqueror, to whom, however, it surrendered without striking a blow, and who selected it as the site of a permanent camp, and erected a wooden fortress on the cliff on which the castle was afterward built. From this camp William, on the morning of October 14, 1066, set out to meet Harold at Senlac Hill; and after his great victory there he returned to it, and remained encamped five days in the hope of receiving the homage of the English.

HASTINGS, WARREN, the first governor-general of British India, was born on December 6, 1732, in the little hamlet of Churchill, in Oxfordshire. He came of a family which had been settled for many generations in the adjoining village of Daylesford. Young Hastings received the elements of education at a charity school in his native village. In 1749 he determined to seek his fortune as a "writer" in Bengal.

When Hastings landed at Calcutta in October, 1750, the affairs of the East India Company were at a low ebb. Throughout the entire south of the peninsula French influence was predominant. The settlement of Fort St. George or Madras, captured by force of arms, had only recently been restored in accordance with a clause of the peace of Aix-la-Chapelle. The brilliant genius of Dupleix everywhere overshadowed the native imagination, and the star of Clive had scarcely yet risen above the horizon. At an early date Hastings was placed in charge of an *aurang* or factory in the interior, where his duties would be to superintend the weaving of silk and cotton goods under a system of money advances. In 1755 he was transferred to Kásimbázár, the river port of the native capital of Múrshidábád. In 1756 the old nawáb died, and was succeeded by his grandson, Siráj-ud-Daulah, a spoilt boy of nineteen, whose name is indelibly associated with the tragedy of the Black Hole. When that passionate young prince, in revenge for a

fancied wrong, resolved to drive the English out of Bengal, his first step was to occupy the fortified factory at Kásimbázár, and make prisoners of Hastings and his companions. Hastings was soon released at the intercession of the Dutch resident, and made use of his position at Múrshidábád to open negotiations with the English fugitives at Falta, the site of a Dutch factory near the mouth of the Hooghly. In later days he used to refer with pride to his services on this occasion, when he was first initiated into the wiles of Oriental diplomacy. After a while, he found it necessary to fly from the Mahometan court, and join the main body of the English at Falta. When the relieving force arrived from Madras, under Colonel Clive and Admiral Watson, Hastings enrolled himself as a volunteer, and took part in the action which led to the recovery of Calcutta. Clive showed his appreciation of Hastings' merits, by appointing him, in 1758, to the important post of resident at the court of Múrshidábád. It was there that he first came into collision with the Bengálí Bráhmaṇ, Nandkumar, whose subsequent fate throws so deep a shadow upon his own fair fame. During his three years of office as resident he was able to render not a few valuable services to the company; but it is more important to observe that his name nowhere occurs in the official lists of those who derived pecuniary profit from the necessities and weakness of the native chiefs. In 1761 he was promoted to be member of council. Macaulay, in his celebrated essay, has said that "of the conduct of Hastings at this time little is known." As a matter of fact, the book which Macaulay was professing to review, describes at length the honorable part consistently taken by Hastings in opposition to the great majority of the council. Sometimes in conjunction only with Vansittart, sometimes absolutely alone, he protested unceasingly against the policy and practices of his colleagues. On one occasion he was stigmatized in a minute by Mr. Batson with "having espoused the Nawab's cause, and as a hired solicitor defended all his actions, however dishonorable and detrimental to the company." An altercation ensued. Batson gave him the lie, and struck him in the council chamber. When war was actually begun, Hastings officially recorded his previous resolution to have resigned, in order to repudiate responsibility for measures which he had always opposed. Waiting only for the decisive victory of Buxar over the allied forces of Bengal and Oudh, he resigned his seat, and sailed for England in November, 1764.

After fourteen years' residence in Bengal Hastings did not return home a rich man, estimated by the opportunities of his position. According to the custom of the time he had augmented his slender salary by private trade. At a later date, he was charged by Burke with having taken up profitable contracts for supplying bullocks for the use of the Company's troops. It is admitted that he conducted by means of agents a large business in timber in the Gangetic sandarbans. While at home Hastings is said to have attached himself to literary society; and it may be inferred from his own letters that he now made the personal acquaintance of Samuel Johnson and Lord Mansfield. In 1766 he was called upon to give evidence before a committee of the House of Commons upon the affairs of Bengal. In the winter of 1768 he received the appointment of second in council at Madras. Among his companions on his voyage round the Cape were the Baron Imhoff, a speculative portrait painter, and his wife, a lady of some personal attractions and great social charm, who was destined henceforth to be Hastings' life-long companion. Of his two years' work at Madras it is needless to speak in detail.

In the beginning of 1772 his ambition was stimulated

by the nomination to the second place in council at Bengal with a promise of the reversion of the governorship when Mr. Cartier should retire. Since his departure from Bengal in 1764 the situation of affairs in that settlement had scarcely improved. The second governorship of Clive was marked by the transfer of the *diwání* or financial administration from the Mogul emperor to the company, and by the enforcement of stringent regulations against the besetting sin of speculation. But Clive was followed by two inefficient successors; and in 1770 occurred the most terrible Indian famine on record, which is estimated to have swept away one-third of the population. In April, 1772, Warren Hastings took his seat as president of the council at Fort William. All the officers of the administration were transferred from Múrshidábád to Calcutta, which Hastings boasted at this early date he would make the first city in Asia. This reform involved the ruin of many native reputations, and for a second time brought Hastings into collision with the wily Brahman, Nandkumar. The Mahrattas at this time had got possession of the person of the Mogul emperor, Sháh Alam, from whom Clive obtained the grant of Bengal in 1765, and to whom he assigned in return the districts of Allahábád and Kora and a tribute of £300,000. With the emperor in their camp, the Mahrattas were threatening the province of Oudh, and causing a large British force to be cantoned along the frontier for its defense. Warren Hastings, as a deliberate measure of policy, withheld the tribute due to the emperor, and resold Allahábád and Kora to the wazír of Oudh. The Mahrattas retreated, and all danger for the time was dissipated by the death of their principal leader. The wazír now bethought him that he had a good opportunity for satisfying an old quarrel against the adjoining tribe of Rohillas, who had played fast and loose with him while the Mahratta army was at hand. The Rohillas were a race of Afghan origin, who had established themselves for some generations in a fertile tract west of Oudh, between the Himalayas and the Ganges, which still bears the name of Rohilkhand. They were not so much the occupiers of the soil, as a dominant caste of warriors and freebooters. But in those troubled days their title was as good as any to be found in India. After not a little hesitation, Hastings consented to allow the company's troops to be used to further the ambitious designs of his Oudh ally, in consideration of a sum of money which relieved the everpressing wants of the Bengal treasury. The Rohillas were defeated in fair fight.

Meanwhile, the affairs of the East India Company had again come under the consideration of parliament. The regulating act, passed by Lord North's ministry in 1773, effected considerable changes in the constitution of the Bengal Government. The council was reduced to four members with a governor-general, who were to exercise certain indefinite powers of control over the presidencies of Madras and Bombay. Hastings was named in the Act as governor-general for a term of five years. The council consisted of General Clavering and the Hon. Colonel Monson, two third-rate politicians of considerable parliamentary influence; Philip Francis, then only known as an able permanent official; and Barwell, of the Bengal Civil Service. At the same time a supreme court of judicature was appointed, composed of a chief and three puisne judges, to exercise an indeterminate jurisdiction at Calcutta. The chief-justice was Sir Elijah Impey, a school-fellow of Hastings at Westminster. The new members of council disembarked at Calcutta on October 19, 1774; and on the following day commenced the long feud which scarcely terminated twenty-one years later with the acquittal of Warren

Hastings by the House of Lords. Macaulay states that the members of council were put in ill-humor because their salute of guns was not proportionate in their dignity. Taking advantage of an ambiguous clause in their commission, the majority of the council (for Barwell uniformly sided with Hastings) forthwith proceeded to pass in review the recent measures of the governor-general. All that he had done they condemned; all that they could they reversed. Hastings was reduced to the position of a cipher at their meetings. After a time they lent a ready ear to detailed allegations of corruption brought against him by his old enemy Nandkumar. To charges from such a source, and brought in such a manner, Hastings disdained to reply, and referred his accuser to the supreme court. The majority of the council, in their executive capacity, resolved that the governor-general had been guilty of speculation, and ordered him to refund. A few days later Nandkumar was thrown into prison on a stale charge of forgery, tried before the supreme court sitting in bar, found guilty by a jury of Englishmen, and sentenced to be hanged. That Hastings set this prosecution in motion, no reasonable person can doubt; but it is by no means clear that Chief-Justice Impey is free from blame. The majority of the council abandoned their supporter, who was executed in due course. While the strife was at its hottest Hastings sent an agent to England, with a general authority to place his resignation in the hands of the company under certain conditions. The agent thought fit to exercise that authority. The resignation was promptly accepted, and one of the directors was appointed to the vacancy. But in the meantime Colonel Monson had died, and Hastings was thus restored, by virtue of his casting vote, to the supreme management of affairs. He refused to ratify his resignation; and when Clavering attempted to seize on the governor-generalship, he obtained an opinion of the supreme court in his own favor. From that time forth, though he could not always command an absolute majority in council, Hastings was never again subjected to gross insult, and his general policy was able to prevail.

A crisis was now approaching in foreign affairs which demanded all the experience and all the genius of Hastings for its solution. Bengal was prosperous and free from external enemies on every quarter. The government of Bombay had hurried on a rupture with the Mahratta confederacy at a time when France was on the point of declaring war against England, and when the mother-country found herself unable to subdue her rebellious colonists in America. Hastings did not hesitate to take upon his own shoulders the whole responsibility of military affairs. All the French settlements in India were promptly occupied. On the part of Bombay, the Mahratta war was conducted with procrastination and disgrace. Hastings amply avenged the capitulation of Wárgáon by the complete success of his own plan of operations. Colonel Goddard with a Bengal army marched across the breadth of the peninsula, from the valley of the Ganges to the western sea, and achieved almost without a blow the conquest of Guzerát. Captain Popham, with a small detachment, stormed the rocky fortress of Gwalior; then deemed impregnable and the key to Central India; and by this feat held in check Sindíá, the most formidable of the Mahratta chiefs. The bhonsla, or Mahratta rájá of Nágpur, whose dominions bordered on Bengal, was won over by the diplomacy of an emissary of Hastings. But while these events were taking place, a new source of embarrassment had arisen at Calcutta. The supreme court, whether rightly or wrongly, assumed a jurisdiction of first instance over the entire province of Bengal. The English common law, with all the

absurdities and rigors of that day, was arbitrarily extended to an alien system of society. *Zamindárs*, or government renters, were arrested on mesne process; the sanctity of the *zanána*, or women's chamber, as dear to Hindus as to Mahometans, was violated by the sheriff's officer; the deepest feelings of the people and the entire fabric of the revenue administration were alike disregarded. On this point the entire council acted in harmony. Hastings and Francis went joint-bail for imprisoned natives of distinction. At last, after the dispute between the judges and the executive threatened to become a trial of armed force, Hastings set it at rest by a characteristic stroke of policy. A new judicial office was created in the name of the Company, to which Sir Elijah Impey was appointed, though he never consented to draw the additional salary offered to him. The understanding between Hastings and Francis, originating in this state of affairs, was for a short period extended to general policy. But a difference of interpretation arose. Hastings recorded in an official minute that he had found Francis' private and public conduct to be "void of truth and honor." They met as duelists. Francis fell wounded, and soon afterward returned to England.

The Mahratta war was not yet terminated, but a far more formidable danger now threatened the English in India. The imprudent conduct of the Madras authorities had irritated beyond endurance the two greatest Mussulman powers in the peninsula, the nizám of the Deccan and Hyder Ali, the usurper of Mysore, who began to negotiate an alliance with the Mahrattas. A second time the genius of Hastings saved the British empire in the east. On the arrival of the news that Hyder had descended from the highlands of Mysore, cut to pieces the only British army in the field, and swept the Carnatic up to the gates of Madras, he at once adopted a policy of extraordinary boldness. He signed a blank treaty of peace with the Mahrattas, who were still in arms, reversed the action of the Madras Government toward the nizám, and concentrated all the resources of Bengal against Hyder Ali. Sir Eyre Coote, a general of renown in former Carnatic wars, was sent by sea to Madras with all the troops and treasure that could be got together; and a strong body of reinforcements subsequently marched southward under General Leslie along the coast line of Orissa. The landing of Coote preserved Madras from destruction, though the war lasted through many campaigns and only terminated with the death of Hyder.

The remainder of Hastings' term of office in India was passed in comparative tranquillity, both from internal opposition and foreign war. The center of interest now shifts to the India House and to the British Parliament. The long struggle between the company and the ministers of the crown for the supreme control of Indian affairs and the attendant patronage had reached its climax. The decisive success of Hastings' administration alone postponed the inevitable solution. His original term of five years would have expired in 1778; but it was annually prolonged by special Act of Parliament until his voluntary resignation. Though Hastings was thus irremovable, his policy did not escape censure. On one occasion Dundas carried a motion in the House of Commons censuring Hastings, and demanding his recall. The directors of the company were disposed to act upon this resolution; but in the court of proprietors, with whom the decision ultimately lay, Hastings always possessed a sufficient majority. Fox's India Bill led to the downfall of the Coalition ministry in 1783. The Act which Pitt successfully carried in the following year introduced a new constitution, in which Hastings felt that he had no place. In February, 1785, he finally sailed

from Calcutta, after a dignified ceremony of resignation, and amid enthusiastic farewells from all classes.

On his arrival in England, after a second absence of sixteen years, he was not displeased with the reception he met with at court and in the country. A peerage was openly talked of as his due, while his own ambition pointed to some responsible office at home. Pitt had never taken sides against him, while Lord Chancellor Thurlow was his pronounced friend. But he was now destined to learn that his enemy, Francis, whom he had discomfited in the council chamber at Calcutta, was more than his match in the parliamentary arena. Edmund Burke had taken the subject races of India under the protection of his eloquence. Francis, who had been the early friend of Burke, supplied him with the personal animus against Hastings, and with the knowledge of details which he might otherwise have lacked. The Whig party on this occasion unanimously followed Burke's lead. Dundas, Pitt's favorite subordinate, had already committed himself by his earlier resolution of censure; and Pitt was induced by motives which are still obscure to incline the ministerial majority to the same side. To meet the oratory of Burke and Sheridan and Fox, Hastings wrote an elaborate minute, and subsidized a swarm of pamphleteers. The impeachment was decided upon in 1786, but the actual trial did not commence until 1788. For seven years Hastings was upon his defense on the charge of "high crimes and misdemeanors." During this anxious period he appears to have borne himself with characteristic dignity, such as is consistent with no other hypothesis than the consciousness of innocence. At last, in 1795, the House of Lords gave a verdict of not guilty on all the charges laid against him; and he left the bar at which he had so frequently appeared, with his reputation clear, but ruined in fortune. However large the wealth he brought back from India, all was swallowed up in defraying the expenses of his trial. At last, when he was reduced to actual destitution, it was arranged that the East India Company should grant him an annuity of £4,000 for a term of years, with £90,000 paid down in advance. This annuity expired before his death; and he was compelled to make more than one fresh appeal to the bounty of the Company, which was never withheld. Shortly before his acquittal he had been able to satisfy the dream of childhood, by buying back the ancestral manor of Daylesford, where the remainder of his life was passed in honorable retirement. In 1813 he was called on to give evidence upon Indian affairs before the two Houses of Parliament, which received him with exceptional marks of respect. The university of Oxford conferred on him the honorary degree of D.C.L.; and in the following year he was sworn of the Privy Council, and took a prominent part in the reception given to the duke of Wellington and the allied sovereigns. He died on August 22, 1818, in his eighty-sixth year, and lies buried behind the chancel of the parish church, which he had recently restored at his own charges.

HASTINGS, FRANCIS RAWDON HASTINGS, FIRST MARQUIS OF, ranks among those governors-general of India who, completing the work of Clive and Warren Hastings, achieved the creation of the Indian empire of England. The services of Lord Hastings in this respect were special and important. He was both governor-general and commander-in-chief in India from 1813 till the end of 1822; during that period he carried two important wars, the Nepaulese and the Mahratta, to a successful issue; while adding to the territories of the East India Company, he in several respects altered and improved their policy; and by the sagacity and at the same time the generosity of his own administration he won

reverence from the natives and left a great name in India.

Lord Hastings was in no way connected with Warren Hastings; his family name was Rawdon. His father, Sir John Rawdon of Moira in the county of Down, fourth baronet, was created Baron Rawdon of Moira, and afterward Earl of Moira, in the Irish peerage. His mother was the Lady Elizabeth Hastings, daughter of the ninth earl of Huntingdon. Lord Rawdon, as he was then called, having gone at an early age to the university of Oxford, joined the army in his seventeenth year as ensign in the 15th foot. His life, henceforth, was entirely spent in the service of his country, and may naturally be divided into four periods—from 1775 to 1782 he was engaged with much distinction in the American war; from 1783 to 1813 he held various high appointments at home, and took an active part in the business of the House of Lords; from 1813 to 1823 was the period of his labors in India; after retiring from which, in the last years of his life (1824–1826), he was governor of Malta.

In America Lord Rawdon served at the battles of Bunker Hill, Brooklyn, White Plains, Monmouth, and Camden, at the attacks on Forts Washington and Clinton, and at the siege of Charleston. In fact he was engaged in all the chief operations of the war.

In 1793 Lord Rawdon succeeded his father as earl of Moira. In 1794 he was sent with 10,000 men from Southampton to Ostend to reënforce the duke of York and the allies in Flanders. In 1803 he was appointed commander-in-chief in Scotland, and in 1804 he married Flora Muir Campbell, countess of Loudon in her own right. The opposition coming into power in 1806, Lord Moira, who had always voted with them, received the place of master-general of the ordnance.

In 1812 Lord Moira received the order of the Garter, and in the same year was appointed governor-general and commander-in-chief of India. He landed in Calcutta, and assumed office in succession to Lord Minto in October, 1813. The Goorkhas, a brave and warlike little nation, failing to extend their conquests in the direction of China, had begun to encroach on territories held or protected by the East India Company; especially they had seized the districts of Bootwul and Seoraj, in the northern part of Oudh, and when called upon to relinquish these, they deliberately elected (April, 1814) to go to war rather than do so. Lord Moira, having traveled through the northern provinces and fully studied the question, declared war against Nepaul (November, 1814). His campaign against the Goorkhas was successful, and he was created marquis of Hastings in 1816.

In 1819 he obtained the cession by purchase of the island of Singapore. In finance his administration was very successful, as notwithstanding the expenses of his wars he showed an annual surplus of two millions sterling. He labored much at law reform, and he succeeded in greatly raising the status and character of the civil service in India. Brilliant and beneficent as his career had been, Lord Hastings did not escape, any more than Clive, Warren Hastings, or Lord Wellesley, the assaults of unjust detraction. His last years of office were embittered by the discussions on a matter very notorious at the time, namely, the affairs of the banking-house of W. Palmer and Company. The whole affair was mixed up with insinuations against Lord Hastings, especially charging him with having been actuated by favoritism toward one of the partners in the firm. He tendered his resignation in 1821, though he did not leave India till January, 1823. In 1824 he received the comparatively small post of governor of Malta, in which island he introduced many reforms and endeared himself to the inhabitants. He died in 1826.

HASTINGS, a rapidly growing town of Nebraska, is situated in Adams county, of which it is the capital. It is a railway center of some importance, and carries on considerable overland commerce. It has good educational, church, banking, and telegraph facilities, and of late years has rapidly increased in its commercial interests, while its population has been more than quadrupled in the last decade, making the number of inhabitants (1890), 13,584. The public buildings include a court-house, city hall, and the State insane asylum. There are four schools, two colleges, and seven churches. The city is lighted by gas and electricity, and has a water-works system costing \$100,000; a system of sewerage is in course of construction. There are thirteen miles of street railroad, and police and fire departments are maintained. The assessed valuation (1889) was \$1,667,900.

HAT, a covering for the head worn by both sexes, and distinguished from the cap or bonnet by the possession of a brim. The modern hat can be traced back to the *petasus* worn by the ancient Romans when on a journey; and hats with brims were also used, probably on like occasions, by the earlier Greeks. It was not until after the Norman conquest that the use of hats began in England. A "hatte of biever" about the middle of the twelfth century was worn by some one of the "nobels of the lande, mett at Clarendom," and Froissart describes hats and plumes which were worn at Edward's court in 1340, when the Garter was instituted. In the thirteenth century the use of the scarlet hat which distinguishes cardinals was sanctioned by Pope Innocent IV. During the reign of Charles I. the Puritans affected a steeple crown and broad-brimmed hat, while the Cavaliers adopted a lower crown and a broader brim ornamented with feathers. Still greater breadth of brim and a profusion of feathers were fashionable characteristics of the hats in the time of Charles II., and the gradual expansion of brim led to the device of looping or tying up that portion. Hence arose various fashionable "cocks" in hats, such as the "Monmouth cock," etc.; and ultimately, by the looping up equally of three sides of the low-crowned hat, the cocked hat which prevailed throughout the eighteenth century was elaborated. Since the beginning of the present century the cocked hat as an ordinary article of dress has disappeared.

Until recent times hats were principally made by the process of felting. At the present day the trade is divided into two distinct classes. The first and most ancient is concerned with the manufacture of felt hats, and the second has to do with the recent but now most extensive and important manufacture of silk or dress hats.

As now made, felt hats are of three different kinds, plain soft, plain hard, and "napped" or "ruffed" felts. There is a great range in the quality of felt hats, the finer and most expensive qualities being made entirely of fur; for commoner qualities a mixture of fur and Saxony wool is used; and for the lowest kinds wool alone is employed. The processes and apparatus necessary for making hats of fur differ also from those required in the case of woolen bodies; and in large manufactories machinery is now generally employed for operations which at no distant date were entirely manual. In the smaller factories, and for special objects, the old hand processes are still in operation.

The silk hat, which has now become coëxtensive with civilization, is an article of recent introduction. It was known in Florence about a century ago; but its manufacture was not introduced into France till about 1825, and its development has taken place entirely since that period. A silk hat consists of a light stiff body covered with a plush of silk, the manufacture of which, in a

brilliant glossy condition, is the most important element in the industry; and in that manufacture the French are without equals. Originally the bodies were made of felt and various other materials, but now calico is almost exclusively used.

The calico is first stiffened with a varnish of shellac, and then cut into pieces sufficient for crown, side, and brim. The side-piece is wound round a wooden hat block, and its edges are joined by hot ironing, and the crown-piece is put on and similarly attached to the side. The brim, consisting of three thicknesses of calico cemented together, is now slipped over and brought to its position, and thereafter a second side-piece and another crown are cemented on. The whole of the body thus prepared, now receives a coat of size, and subsequently it is varnished over, and thus it is ready for the operation of covering. In covering this body, the under brim, generally of merino, is first attached, then the upper brim, and lastly the crown and side sewed together are drawn over. All these, by hot ironing and stretching, are drawn smooth and tight, and as the varnish of the body softens with the heat, body and cover adhere all over to each other without wrinkle or pucker. Dressing and polishing by means of damping, brushing, and ironing, come next, after which the hat is "velured" in a revolving machine by the application of haircloth and velvet velures, which cleans the nap and gives it a smooth and glossy surface. The brim has only then to be bound, the linings inserted, and the brim finally curled, when the hat is ready for use. In all kinds of hat-making the French excel, and in such centers as Anduze, Lyons, and Paris, the trade is very extensive and important. In the United Kingdom the felt hat trade is principally centered at Denton and other localities in the neighborhood of Manchester, and in the United States New York and New Jersey enjoy the greater part of the industry.

HATFIELD, or BISHOP'S HATFIELD, a quiet, old-fashioned market-town of England, in the county of Hertford, seventeen and three-quarter miles north-northwest of London. In the vicinity is Hatfield House, on the site of a palace of the bishops of Ely, which was erected about the beginning of the twelfth century. In 1538 the manor was resigned to Henry VIII. by Bishop Goodrich, in exchange for certain lands in Cambridge, Essex, and Norfolk, and after that monarch the palace was successively the residence of Edward VI. immediately before his accession, of Queen Elizabeth during the reign of her sister Mary, and of James I. The last-named exchanged it in 1607 for Theobalds, near Cheshunt, in the same county, an estate of Sir Robert Cecil, afterward earl of Salisbury, in whose family Hatfield House has since remained. It is now the residence of the marquis of Salisbury, prime minister of England.

HATHRAS, or HATRAS, a town in the Aligarh district, Northwestern Provinces, India. It is well built, with numerous brick and stone houses, and is a prosperous trading center. Population 23,589, comprising 21,121 Hindus and 2,468 Mahometans.

HATTINGEN, a town of Westphalia, Prussia, in the government district of Arnsberg and the circle of Bochum, is situated on the river Ruha, about twenty-one miles northeast of Düsseldorf. Population (1890) 8,000.

HATTO I., tenth archbishop of Mainz, was born of a Swabian family about the middle of the ninth century. Educated at the monastery of Ellwangen or at Fulda, he attracted the attention of the emperor Arnulf, who in 888 made him abbot of Reichenau, in 889 abbot of Ellwangen, and in 891 archbishop of Mainz. During his reign Hatto acquired much ecclesiastical as well as political power. He presided over the council at Tribur or

Teuver (895), at which the emperor and twenty-six or twenty-seven bishops attended, and was employed as ambassador to Charles the Simple and the king of Lorraine at their conference at Saint Goar in 899. On the death of Arnulf in 900, Hatto became regent and guardian of Louis, and in the contest with the dukes of Babenberg treacherously betrayed into the emperor's hands Count Adalbert, who was one of their partisans. Under Louis' successor, Conrad I., Hatto retained his influence, but he died in 913, two years after Conrad's accession. Another but less probable account has it that he was killed at the battle of Heresburg in 912. There is a tradition, due probably to his ambition and violence, that his corpse was seized by the devil and thrown into the crater of Mount Etna. The tradition of the Mouse Tower on the Rhine at Bingen is connected with another Hatto, also archbishop of Mainz (968-970).

HATVAN, a market-town in the county of Heves, Hungary, is situated on the left bank of the Zagyva, at the junction of the Pest-Miskolcz, Hatvan-Rutka, and Hatvan-Szolnok lines of railway, about thirty miles east-northeast of Budapest. Population, 4,500.

HATZFELD, a market-town in the county of Tórontál, Hungary, on the Austrian state line of railway, about twenty-two miles west of Temesvár. Population (1890), 9,000.

HAUCH, JOHANNES CARSTEN, Danish poet, was born of Danish parents residing at Frederikshald in Norway in 1790. His first dramas, *The Journey to Ginistan* and *The Power of Fancy*, appeared in 1816 and 1817, and were followed by *Flosaura*; but these works attracted little or no attention. Hauch therefore gave up all hope of fame as a poet, and resigned himself entirely to the study of science, to pursue which he went abroad. He returned to dramatic production, and published *The Hamadryad*, *Bajazet*, *Tiberius*, *Gregory VII.*, *The Death of Charles V.* (1831) and *The Siege of Maestricht* (1832). Hauch then turned to novel writing, and published in succession four romances—*Vilhelm Zabern*, 1834; *Guldageren*, 1836; *A Polish Family*, 1829; and *The Castle on the Rhine*, 1845. In 1842 he collected his shorter *Poems*. In 1846 he was appointed professor of the Scandinavian languages in Kiel. He produced several tragedies, among which may be mentioned *Svend Grathe*, 1841; *The Sisters at Kinnekullen*, 1849; *Marsk Stig*, 1850; *Honor Lost and Won*, 1831; and *Tycho Brahe's Youth*, 1852. From 1858 to 1860 Hauch was director of the Danish National Theater; he produced three more tragedies—*The King's Favorite*, 1859; *Henry of Navarre*, 1863; and *Julian the Apostate*, 1868. In 1861 he published another collection of *Poems*, and in 1862 the historical epic of *Valdemar Atterdag*. He died in Rome in 1872.

HAUFF, WILHELM, a popular German novelist, was born at Stuttgart, 1802. In 1818 he was sent to the *Klosterschule* at Blaubeuren, and two years later entered the seminary at Tübingen. After having completed, in 1824, his philosophical and theological studies and taken his degree, he acted for two years as private tutor, and assumed, in January, 1827, the editorship of the *Morgenblatt*. In the following month he married, and led a happy and quiet life, which was ended by a fatal illness on November 18th of the same year.

HAUG, JOHANN CHRISTOPH FRIEDRICH, a German epigrammatist, was born March 19, 1761, at Niederstotzingen, in Würtemberg, and died in 1829.

HAUG, MARTIN, Orientalist, was born in 1827, near Balingen, Würtemberg, and died in 1876.

HAUGE, HANS NIELSEN, founder of a religious sect within the Lutheran Church of Norway and Denmark, was born in the former country, in the parish of Thunö, April 3, 1771, and died in 1824.

HAUPT, MORITZ or MORIZ, one of the principal representatives at once of classical and of vernacular philology in Germany, was born at Zittau, in Lusatia, in 1808, and died in 1874.

HAUPTMANN, MORITZ, was born at Dresden, October 13, 1792, and studied music under Scholz, Lanska, Grosse, and Morlacchi, the rival of Weber. Afterward he completed his education as a violinist and composer under Spohr. For a time also Hauptmann was employed as an architect, but all other pursuits gave place to music, and a grand tragic opera, *Mathilde*, belongs to the period just referred to. In 1822 he entered the orchestra of Cassel, again under Spohr's direction, and it was then that he first taught composition and musical theory to such men as Ferdinand David, Burgmüller, Kiel, and others. His compositions at this time chiefly consisted of motets, masses, cantatas, and songs. His opera *Mathilde* was performed at Cassel with great success. In 1842 Hauptmann obtained the position of orator at the Thomas-school of Leipsic (long previously occupied by the great Johann Sebastian Bach). He died on January 3, 1868. Hauptmann's compositions are marked by symmetry and perfection of workmanship rather than by spontaneous invention.

HAURAN. See BASHAN.

HAUSER, KASPAR, a German youth whose life was remarkable from the circumstances of apparently inexplicable mystery in which it was involved. He appeared on May 20, 1828, in the streets of Nuremberg, dressed in the garb of a peasant, and with such a helpless and bewildered air that he attracted the attention of the passers-by. In his possession was found a letter purporting to be written by a poor laborer, stating that the boy was given into his custody on October 7, 1812, and that according to agreement he had instructed him in reading, writing, and the Christian religion, but that up to the time fixed for relinquishing his custody he had kept him in close confinement. Along with this letter was inclosed another purporting to be written by the boy's mother, stating that he was born on April 30, 1812, that his name was Kaspar, and that his father, formerly a cavalry officer in the sixth regiment at Nuremberg, was dead. The appearance, bearing, and professions of the youth corresponded closely with these credentials. He showed a repugnance to all nourishment except bread and water, was seemingly ignorant of outward objects, wrote his name as Kaspar Hauser, and said that he wished to be a cavalry officer like his father. For some time he was detained in prison at Nuremberg as a vagrant, but on July 18, 1828, he was delivered over to the care of Professor Daumer, who undertook to be his guardian and to take the charge of his education. On October 17, 1829, he was found to have received a wound in the forehead, which according to his own statement had been inflicted on him by a man with a blackened face. Having on this account been removed to the house of a magistrate and placed under close surveillance, he was visited by Earl Stanhope, who became so interested in his history that he sent him to Ansbach to be educated. After this he became clerk in the office of Feuerbach, president of the court of appeal, and his strange history was almost forgotten by the public when the interest in it was suddenly revived by his death on December 14, 1833, from a deep wound on his left breast. He affirmed that the wound was inflicted by a stranger, but many believed it to be the work of his own hand, and that he did not intend it to be fatal, but only so severe as to give a sufficient coloring of truth to his story.

HAÜY, RENÉ JUST, an eminent French mineralogist, commonly styled the Abbé Haüy, from being an honor-

ary canon of Notre Dame, was born at St. Just, in the department of Oise, February 28, 1743, and died in 1822.

HAVANA, HAVANNAH, or HABANA, more fully San Cristobal de la Havana, the capital of Cuba, and one of the principal seats of commerce in the New World, is situated on the northern coast of the island. From the sea it presents a picturesque appearance. The background is indeed tame; but the long lines of fortifications, the church-towers, and the shipping relieve the somewhat tawdry effect of the gayly colored houses. Most of the houses are built of solid stone, and have flat roofs, after the manner in vogue in southern Spain, and, as the erection of wooden buildings has been illegal since 1772, it is only in the suburban districts that they are at all common. The lavish use of white marble in the decoration both of shops and dwelling-houses is one of the peculiarities of the popular taste; and it is worthy of remark that, though the native quarries would supply what is wanted, the marble is brought from Genoa. Cafés, restaurants, clubs, and casinos are both exceedingly numerous and largely frequented, forming a good indication of that general absence of domestic life among the white population which surprises the European visitant. Havana is still, as of yore, a city of smells and noises. There is no satisfactory cleaning of the streets or draining of the subsoil, and the harbor is visibly rendered foul by the impurities of the town. Victorias,—of which it is the Cuban boast that there are 6,000,—volantes, and other vehicles are driven through the thoroughfares with the utmost recklessness; and tramways and railways in the American fashion contribute to the confusion.

The principal defenses of Havana are the Castillo de la Punta, to the west of the harbor entrance, the Castillo del Morro and San Carlos de la Cabaña to the east, the Santo Domingo de Atares, which lies at the head of the western arm of the bay, and commands both the city and the neighborhood, and the Castillo del Principe, situated on an eminence to the west, and forming the terminus of the great Paseo Militar. El Morro, as it is popularly called, was first erected in 1589, but additions have been frequently made. La Punta, a much smaller fort, is of the same period. The castle of Atares dates from about 1763, when the Conde de Ricla was governor of the island. Cabaña, which alone has accommodation for 4,000 men, fronts the bay for a distance of 800 yards, and is defended on the land side by three bastions. To the east there lies a smaller fort, No. 4, or San Diego, on a hill about 100 feet high.

Of the churches in the city, which number more than a score, the most noteworthy is the cathedral erected in 1724 by the Jesuits. Externally it is plain though symmetrical; but within it has richly frescoed walls, a floor of variegated marble, and costly altars. In the wall of the chancel, a second-rate medallion and a sorrier inscription distinguish the tomb of Columbus, whose remains were removed thither in 1796.

Besides the university established in 1728, the city possesses a theological seminary, a military school, and a school of art. The governor and the bishop have their respective palaces, the former a large yellow stone building in the Plaza de Armas; a large prison, erected in 1771, capable of receiving 500 inmates, and with barracks for a regiment, forms a striking object in the general view of the city; and among the other public buildings are the exchange, the custom-house (formerly the church of San Francisco), and the maestranza or headquarters of the artillery. Of the theaters, which have still to compete with the bull-ring and the cock-pit, the most important is the Tacon, erected in 1838, and

capable of accommodating about 3,000 persons. The promenades, drives, and public gardens form a notable feature of Havana; it is sufficient to mention the Plaza de Armas, with a statue of Ferdinand VII; the Prado or Paseo Isabel, a long and handsome boulevard laid out in the eighteenth century; the Campo del Marte or drill-park; the Parque Isabel, the Paseo Tacon, the botanical gardens, and the gardens of Los Molinos, the suburban residence of the captain-general. The palm-tree avenues of Los Molinos are unusually fine.

The bay of Havana makes one of the finest harbors in the world, easy of access, spacious enough to contain about 1,000 large vessels, deep enough to allow them to come close up to the wharves, and, except in the case of a hurricane, well protected on all sides. The entrance, encumbered by neither bar nor rock, is 980 feet wide and 4,200 feet long. Within, the bay breaks up into three distinct arms, named respectively Marimaleña or Regla Bay, Guasabacoa Bay, and El Fonda or Bay of Atares. The wharves are well built, and a good floating dock is maintained by a private company. On the left hand of the entrance stands a lofty light-house tower.

In spite of high tariffs and civil wars, and the competition of Matanzas, Cardenas, Cienfuegos and other Cuban ports open to foreign trade in modern times, the commerce of Havana continues to increase. The staple manufacturing industry of Havana is that of tobacco. Of the cigar factories, more than a hundred may be reckoned as of the first class. The Royal and Imperial Factory of La Honradez, which occupies a whole square, and is considered one of the great sights of the city, produces daily 2,532,000 cigarettes. Besides the making of boxes and barrels, and other articles necessarily involved in its sugar and tobacco trade, Havana also prosecutes to some extent the building of carriages and ships, and the manufacture of iron and machinery; but the weight of taxation is too great to allow the development of any business requiring great capital. There are six banks in the city, the most important being the Spanish Bank, through which all the Government paper is issued.

Havana has steam communication with New York, Baltimore, Philadelphia and New Orleans; and with several ports in England, Spain and France. It is the terminus of a railway system which reaches Cardenas, Cienfuegos, Matanzas, Batabano, etc., and short lines run out to the Bay of Havana and Marianas. Telegraphs radiate to all parts of the island, and a submarine cable to Key West forms part of the line of communication between Aspinwall and New York.

The population of Havana and its suburbs is 300,000. Among the white population the proportion of males to females is extraordinarily high; according to the official returns, there die annually 3,628 white males to 1,264 white females. The average rate of mortality is twenty-seven per thousand annually. Foreigners are subject to yellow fever, especially from June to September.

Havana, originally founded by Diego Velasquez in 1515 on an unhealthy site near the present harbor of Baracon on the south coast, was removed to its present position about 1519, and soon began to be considered one of the most important places in the New World. In 1528 the buccaneers laid the settlement in ashes, but it was soon after restored by Da Soto, who built the fortress of La Fuerza. The residence of the captain-general was transferred to Havana from Santiago de Cuba in 1551; and in 1589, to protect the city, which had been plundered by the pirate Jacob Sores in 1555, and threatened by Drake in 1585, Philip II. of Spain ordered the erection of the Bateria de la Punta and the castle of El Morro or Los Tres Reyes. In the

course of the seventeenth century the port became the great rendezvous for the gold-ships of Spain, and the commercial center of the Spanish possessions in America. The English, under Admiral Pocock and the duke of Albemarle, captured Havana in 1762, but it was restored to the Spaniards on February 10, 1763, in exchange for the Floridas. (See CUBA.)

HAVELBERG, an ancient town of Brandenburg, Prussia, with a population (1890) of 7,000.

HAVELOCK, SIR HENRY, an eminent British soldier, was born at Ford Hall, Bishop-Wearmouth, Sunderland, in 1795, and in 1815 accepted a second lieutenancy in the Rifle Brigade (95th). During the following eight years of service in Britain he read extensively and acquired a good acquaintance with the theory of war. He followed his brothers William and Charles to India, first qualifying himself in Hindustani under Doctor Gilchrist, a celebrated Orientalist. At the close of twenty-three years' service he was still a lieutenant, and it was not until 1838 that, after three years' adjutancy of his regiment, he became captain. Before this, however, he had held several staff appointments. During the first Afghan war he was present as aide-de-camp to Sir Willoughby Cotton at the capture of Ghazni, July 29, 1839, and at the occupation of Cabul. After a short absence in Bengal to secure the publication of his *Memoirs of the Afghan Campaign*, he returned to Cabul in charge of recruits, and became interpreter to General Elphinstone. In 1840, being attached to Sir Robert Sale's force, he took part in the Khurd-Cabul fight, in the celebrated passage of the defiles of the Ghilzees (1841), and in the fighting from Tezeen to Jellalabad. Here, after many months' siege, his column in a sortie *en masse* defeated Akbar Khan, April 7, 1842. He was now made deputy adjutant-general of the infantry division in Cabul, and in September he assisted at Jugdulluk, at Tezeen, and at the release of the British prisoners at Cabul, besides taking a prominent part at Istaliff. Having obtained a regimental majority he next went through the Mahratta campaign as Persian interpreter to Sir Hugh (Viscount) Gough, and distinguished himself at Maharajpûr in 1843, and also in the Sikh campaign at Mudki, Ferozeshah and Sobraon in 1845. In 1854 he became quartermaster-general, then full colonel, and lastly adjutant-general of the troops in India. In 1857 he was selected by Sir James Outram for the command of a division in the Persian campaign, during which he was present at the actions of Mohummarah and Ahwaz. Peace with Persia set him free just as the mutiny broke out; and he was chosen to command a column "to quell disturbances in Allahabad, to support Lawrence at Lucknow and Wheeler at Cawnpore, to disperse and utterly destroy all mutineers and insurgents." At Futteh-pûr, July 12th, at Aong and Pandoonudee on the 15th, at Cawnpur on the 16th, at Onao on the 29th, at Buserutgunge on the 29th, and again on August 5th, at Boorhiya on August 12th, and at Bithoor on the 16th, he defeated overwhelming forces. Twice he advanced for the relief of Lucknow, but twice prudence forbade a reckless exposure of troops wasted by battle and disease in the almost impracticable task. Reënforcements arriving at last under Outram, he was enabled by the generosity of his superior officer to crown his success on September 25, 1857, by the capture of Lucknow. There he died November 24, 1857, of dysentery.

HAVERCAMP, SIGEBERT, classical editor and numismatist, was born at Utrecht, and died at Leyden, April 23, 1742.

HAVERFORDWEST, the chief town of Pembroke-shire, Wales. Population (1890), 7,500.

HAVERHILL, a city in Essex county, Mass., is

situated on the north bank of the Merrimack river, eighteen miles from its mouth, and opposite the town of Bradford and Groveland, with which it is connected by two fine bridges. It has railway communication with Boston, which is thirty-two miles south, and with Portland, seventy-eight miles north. The city contains a handsome soldiers' monument of white marble, erected in 1869, several public halls, including the city hall, the Freemasons' and Oddfellows' halls, and a public library with 30,000 volumes. Haverhill derives its prosperity from the manufacture of boots and shoes, chiefly of the finer kinds, in which about 150 firms are engaged. Besides these there are about forty manufactories of different articles used in this trade, as heels, lasts, shoe-nails, etc. The other manufactures include hats, paper-boxes, and woolen goods. The first settlement at Haverhill was made in 1640, and for seventy years as a frontier town it suffered much from savage attacks. A fine granite and bronze monument has been recently erected to commemorate the heroism of the early settlers. Haverhill was incorporated in 1645, and received a city charter in 1870. Population (1890), 27,412.

HAVERSTRAW, a New York town, lies in Rockland county, on the west bank of the Hudson (Tappan Bay), about thirty-five miles north of New York city. The town is noted principally for its manufactures of bricks and brick-making machinery. It also has other manufactures, among them being iron, machinery, paper, baskets, etc. Considerable trade with the adjoining county and Peekskill and New York city is carried on. Population (1890) about 6,000. It has banks, railroads and telegraphs.

HAVRE, LE (originally HAVRE DE GRÂCE), a town of France, the second to Marseilles in importance as a seaport, capital of an arrondissement in the department of Seine-Inférieure, is situated on the north bank of the estuary of the Seine, 143 miles northwest of Paris and fifty-five west of Rouen. The greater part of the town stands on a level plain, but from the heights on which Ingouville, since 1856 united to Havre, is situated, a charming and varied prospect is obtained. In the lower part of the town the streets run chiefly in straight lines, and they are grouped round the basins or docks which communicate by lockgates, and are placed so as to form a triangle entered from the Outer Port. The old fortifications surrounding the town were demolished in 1856, and it is now defended by forts erected on the heights of Ingouville and Sainte-Adresse. The principal street is the Rue de Paris, running from north to south in the center of the town, and among the principal promenades may be mentioned the Boulevard de Strasbourg, the Place Louis XVI., and the Jetée du Nord, which terminates in a lighthouse. Havre possesses a tribunal of the first instance, a tribunal of commerce, an exchange and chamber of commerce, a chamber of agriculture, a hydrographic school, and a communal college. The principal buildings are the churches of Notre Dame and St. Francis, the new Hôtel de Ville, the Musée, containing apartments for a library, and for art, antiquities, and natural history, and with statues in front of *Bernardin de St. Pierre* and *Casimir Delavigne*, natives of Havre, by David Angers; the theater, the clubhouse called the *Cercle du Commerce*, the new palace of justice, the marine arsenal, the town-house, the custom-house, and the Frascati bath-house. The docks are among the finest in the world, and consist of eight separate basins, which, with the late enlargement of the outer harbor, afford 150 acres of accommodation for vessels. The new entrance to the harbor has a width of 100 meters or 328 feet. Lines of rails have been laid along the docks. As these have absorbed much of the space on the quays,

loading is frequently a slow and tedious process, but the completion of the lately projected harbor affords all the facilities necessary in this respect. In the extensive shipbuilding yards of Havre the finest vessels of France are built, and many are also built for other countries. Havre is now fortified as a fleet station and harbor of war. The port has regular steam communication with London, Liverpool, Southampton, Dublin, Glasgow, Hull, Swansea, Bristol, Dunkirk, Brest, Cherbourg, Rotterdam, Hamburg, Copenhagen, St. Petersburg, Constantinople, West Indies, San Francisco, Vancouver Island, and New York. The average annual value of exports and imports is about 2,800,000,000 francs. The trade of Havre with the United States is very large, and it has always retained its superiority in the importation of cotton, one-third of which, however, it imports from other countries than America. It is also the chief port for the exportation of French goods to the United States, and an important point of emigration. Besides cotton its principal imports are petroleum, coals, wheat, woolen, silk, flax, mohair and jute tissues, spices, sugar, coffee, hides, dyewoods, and building timber. The principal exports are various French manufactured cloths, leather, jewelry, agricultural and dairy produce, wine, brandy, and oil. Fishing is extensively prosecuted. Besides the various industries connected with shipbuilding, Havre possesses sugar-refining works, tobacco manufactories, iron foundries, salt works, breweries, vitriol works, and manufactures of *faience*, lace, silk, and paper. It is also much frequented for sea-bathing. The population is about 90,000.

HAWAIIAN OR SANDWICH ISLANDS, THE, a group of eight inhabited and four uninhabited islands in the North Pacific Ocean. From Honolulu, the capital, on Oahu, the distance to San Francisco is 2,100 miles; to Auckland, New Zealand, 3,810 miles; to Sydney, New South Wales, 4,484 miles; to Yokohama, 3,440 miles; to Hongkong, 4,893 miles; to Tahiti, 2,380 miles. The first of the names by which the group is designated above is taken from that of the largest island, Hawaii, and is the name adopted by the inhabitants. The other name was given to it by Captain Cook the discoverer, in honor of the earl of Sandwich, first lord of the Admiralty at the time of the discovery.

These islands, the most important Polynesian group in the North Pacific, were discovered by Captain Cook in 1778. In the following year he was killed by a native when he landed in Kealahakua bay in Hawaii. At the time of Cook's visit each island had its chief. On the death of the chief who ruled Hawaii at that time there succeeded one named Kamehameha, who appears to have been a man of quick perception and great force of character. When Vancouver visited the islands, 1792, this chief being desirous of possessing a vessel on the European model, the keel of one was laid down for him. Ten or twelve years later Mr. Turnbull found him with twenty vessels of from twenty-five to fifty tons which traded among the islands, and he afterward purchased others from foreigners. Having encouraged a warlike spirit in his people and introduced firearms, Kamehameha attacked and overcame the chiefs of the other islands one after another, until he became undisputed master of the whole group. He encouraged trade with foreigners, and derived from its profits a large increase of revenue as well as the means of consolidating his power. He died in 1819, and was succeeded by his son, a mild and well-disposed prince, but destitute of his father's energy. One of the first acts of Kamehameha II. was to abolish *tabu* and idolatry throughout the islands. Some disturbances were caused thereby, but the insurgents were defeated and the peace

of the islands has been scarcely broken since. In 1820 missionaries arrived from America and commenced their labors at Honolulu. A short time afterward the British Government presented a small schooner to the king, and this afforded an opportunity for the Rev. William Ellis, the well-known English missionary, to visit Honolulu, along with a number of Christian natives from the Society Islands. Finding the language of the two groups nearly the same, Mr. Ellis, who had spent several years in the southern islands, was able to assist the American missionaries in reducing the Hawaiian language to a written form. In 1824 the king and queen of these islands paid a visit to England, and both died there of measles. For many years the Hawaiians have continued to advance steadily in intelligence, resources, and civilization, but their progress has been at times interrupted by the conduct of the officers of foreign powers. On one occasion a British officer went so far as to take possession of Oahu and establish a commission for its government; and French officers abrogated the laws, dictated treaties, and by force of arms established the Roman Catholic religion in the country. The act of the British officer was disavowed by his superiors as soon as known; and these outrages led to a representation on the part of the native sovereign to the governments of Great Britain, France, and the United States of America, and the independence of the islands was guaranteed by these powers in 1844. Kalakaua, the late monarch, was elected king by ballot on Lunalilo's death without heirs in 1874. He died in January, 1891, and was succeeded by his sister, who is married to an American.

In 1876 King Kalakaua visited the United States, at which occasion the reciprocity treaty was concluded, admitting Hawaiian raw sugar into the United States and many American products into the Sandwich Islands free of duty. In 1881 Kalakaua made a tour of the world with the object of promoting immigration, but the only practical result of the trip was a convention with Japan, while the king acquired a taste for royal display and extravagance which caused great calamity to his kingdom. A royal palace was built at a cost of \$1,000,000; the government ran into debt to Claus Spreckels, the San Francisco sugar refiner, for money advanced to defray current expenses to the amount of \$750,000. When he refused to lend a larger sum without security, a syndicate of London capitalists was formed, and negotiations for a loan of \$10,000,000 were carried on through an intermediary named McFarlane with an English banker. Walter M. Gibson, a prominent politician, who came to the country as agent of the Mormons for the purchase of land when they thought of emigrating from the United States, became a large land owner, and assumed the part of a champion of the rights and interests of the native race. This man succeeded in being elected into the new ministry which at the time of the loan transaction was about to be formed. The loan act was passed, and received the signature of the king. The legislature, composed for the most part of Kanakas elected by corrupt means, passed also an appropriation bill amounting to \$4,552,477, the revenue being estimated at \$2,839,924 which was greatly in excess of the probable yield. This act and the ever-increasing prodigality of the king roused the anger of the white population who pay the bulk of the taxes. The Americans especially who had been instrumental in developing the resources of the country and possessed the main commercial interests, showed openly their dissatisfaction at the state of affairs, and as there was no change to be expected at the hands of Gibson, who, relying upon the support of the natives, treated the white population with contempt, revolutionary plans

were discussed. At this stage of affairs a scandal transpired which afforded a pretext for action. A Chinese planter and mill owner received from the king a license for the opium trade and paid as remuneration for this royal favor a large sum of money. Having paid the agreed \$60,000, he learned to his grief that the ever-needy king had granted the license to another celestial who had agreed to share the profits with the monarch. When the deceived Chinese went to the king to demand his money back, Kalakaua told him that he had made it by smuggling, and it had now come to the rightful owner.

The white residents of the capital laid their plans of revolution with deliberation, and on June 25, 1887, as soon as 1,000 rifles and the necessary ammunition had arrived from San Francisco, they took possession of the city. Gibson was arrested, and the king compelled to form a new ministry. Then an amended constitution was drawn up by a committee of revision. When completed, it was submitted to the king, who affixed his signature and took the oath to support it. The new constitution establishes the principle of ministerial responsibility, takes away the king's right to nominate the members of the upper chamber, and deprives him of all legislative powers.

The area of the inhabited islands is as follows: Hawaii, 4,850 square miles; Maui, 750 square miles; Oahu, on which the capital Honolulu is situated, 700 square miles; Kauai, 780 square miles; Molokai, 170 square miles; Sanai, 170 square miles, and Niihau, 110 square miles. The population of the kingdom at the time of the last census, December 27, 1884, was 80,578 persons, divided into 51,539 males and 29,039 females. There were 40,014 natives, 17,939 Chinese, 17,335 whites, 4,218 métis, 116 Japanese, and 956 others. The white population embraced 2,066 Americans, 1,282 English, 1,600 Germans, 192 French, 9,377 Portuguese, 778 of other nationalities, and 2,040 children of foreigners born in the country. Of the 5,410 immigrants, in 1885, 3,108 came from China, 1,961 from Japan, the importation of laborers from the latter country being encouraged at that time by the government, the Chinese laborers who were formerly brought to cultivate the sugar plantations having proved objectionable. About 10,000 Portuguese from the islands of St. Michaelis and Madeira have been imported for the same purpose. In 1886 there were 3,725 arrivals and 2,189 departures. A strange feature is the very stringent passport law, no person after a month's residence being permitted to leave the kingdom without a passport, which cannot be granted to any one indebted to the government or to any private individual, or to a defendant in a criminal or civil suit, or to any applicant against whom complaint is made that he is leaving without providing for the maintenance of his family. The population was probably 200,000, when Captain Cook discovered the islands, but within a century the indigenes have decreased to their present number.

The natives belong to the Malayo-Polynesian race. Their reddish-brown skin has been compared to the hue of tarnished copper. The hair, usually raven black, is straight or at most wavy; the beard is thin, the face broad, the profile not prominent, the nose rather flattened, and the lips thick. The bulk of the population are of moderate stature, but the chiefs and the women of their families are remarkable for height.

In the former state of society the habits of the people were extremely licentious; men were living with several wives, and women with several husbands. Female virtue was an unknown thing, and there is no native word for it. This state of things has, however, been greatly altered by the exertion of the missionaries.

As regards cannibalism, it appears that the heart and liver of the human victims offered in the temples were eaten as a religious rite, and that the same parts of any prominent warrior slain in battle were devoured by the victor chiefs in the belief that they would thereby inherit the valor of the dead man. When, on the death of the great warrior Kamehameha I., the chiefs assembled to deliberate what should be done with his body, one suggested that they should eat it, but this did not find favor with the others.

The Hawaiians are a good-tempered, light-hearted, and pleasure-loving race. They have many games and sports, and the women spend much time in making flower garlands. Both sexes are passionately fond of riding, almost every one being in possession of a horse. They delight to be in the water, and swim with remarkable skill and ease. In the exciting sport of surf swimming, which always astonishes strangers, they balance themselves while standing or sitting on a small board which is carried landward on the curling crest of a great roller.

The language is a branch of the widely-diffused Malayo-Polynesian tongue; and Hawaiians and New-Zealanders, although occupying the most remote regions north and south at which any of their race have been found, can understand each other without much difficulty. This language is soft and harmonious, being highly vocalic in structure.

The native dwellings are constructed of wood, or more frequently are huts thatched with grass at the sides and top. What little cooking is undertaken is done outside. The oven consists of a hole in the ground in which a fire is lighted and stones made hot; and the fire having been removed, the foot is wrapped up in leaves and placed in the hole beside the hot stones and covered up until ready.

Leprosy is prevalent among the natives, and the government has established a settlement on the island of Molokai, where all persons found to be affected with the disease are kept entirely isolated from the healthy part of the community. The lepers number about 800.

The pasture lands of Hawaii and some of the other islands are favorable to the breeding of cattle. Sub-tropical plants and shrubs are brought to great perfection on the plains near the sea-level. Sugar is the most valuable crop of the kingdom. In 1884 there were in the islands 30,140 horses, 117,613 cattle, 121,683 sheep, 21,860 goats, 2,942 mules, and 278 asses, besides hogs and a large quantity of poultry. The sugar crop of 1886 was the largest ever obtained, amounting to 115,000 tons. The crop of 1887 was estimated at 100,000 tons. The low price of sugar, and the uncertainty regarding reciprocity with the United States recently led to practical attempts to utilize the other natural resources of the country.

No country in the world has as large a commerce as the Hawaiian Kingdom, in proportion to its population. The exports for 1885 were about \$125 per head of the population. Most of the foreign trade is in the hands of the United States. In 1886 ninety-four per cent. of the total foreign commerce was with the United States, which imported merchandise of the value of \$4,002,000. Of the exports \$10,324,000 went to the United States, while Germany took \$12,000, and other countries \$4,000. The importation of coin and bullion in 1886 was \$1,142,946, and the exportation \$43,277. The export of sugar has increased from 3,006,000 pounds in 1862 to 142,655,000 pounds in 1884, 171,350,000 pounds in 1885 and 216,223,000 pounds in 1886. The export of rice increased from 111,000 pounds in 1862 to 9,535,000 pounds in 1884, but has since fallen off to 7,367,000 pounds in 1885, and

7,339,000 pounds in 1886. The export of coffee was 146,000 in 1862, but only 4,000 pounds in 1884, 2,000 pounds in 1885, and 600 pounds in 1886. The export of wool was 40,000 pounds in 1862, 408,000 pounds in 1884, 474,000 pounds in 1885, and 419,000 pounds in 1886. There were 58,040 bunches of bananas exported in 1884, 60,046 in 1885, and 45,862 in 1886. The number of hides of cattle and skins of calves and goats exported in 1862 was 68,537; in 1884, 49,306; in 1885, 47,636; and in 1886, 61,740. The official returns for 1885 show a sugar production of 171,350,314 pounds, out of which the United States took 171,346,625 pounds. The crop of rice for 1885 was large, though it fell short of the production of the four preceding years. The United States consumed 7,362,200 pounds out of a total production of 7,367,253 pounds. The entire exports of fresh bananas, of goat-skins, 19,782; hides, 19,045; and sheep-skins, 8,783, were consumed by America. The crop of wool, amounting to 474,121 pounds, was exported to England.

When Cook arrived at the islands he found there hogs, dogs, and rats. There is a day-flying bat; a small lizard is found, but no other reptiles. Cattle, goats, and hogs at the present day run wild upon the mountains in the larger islands, and do much damage to the woods. As to the birds, fifty-three species have been enumerated by Mr. Sanford Dole, but it is thought that many more species remain to be discovered in the mountain districts.

The ravines and mountain slopes on the windward side of the larger islands contain much forest growth, whilst the leeward uplands and plains are comparatively bare. Among the more remarkable forms are a *Pandanus*, or screw pine, and the *Aleurites*, or candle-nut tree, so named from the natives stringing together the kernels, which are very oily, and so making a candle. Sandalwood, formerly plentiful, has been exhausted. The cocoa-nut palm grows in abundance on the coast.

Though the islands are mountainous, none of the eminences reach the limit of perpetual snow. All the islands are of volcanic origin and are entirely composed of the products of eruption. On one of them (Hawaii) the volcanic forces are still in operation; on all the others they have been quiescent for an indefinite period, and the superficial rocks are in a more or less advanced state of decay.

The form of government is a constitutional monarchy, with a legislature composed of twenty nobles appointed by the king for life, and twenty-eight representatives elected every two years by the people — the two classes sitting together. An annual income of \$75 is the qualification of an elector. The king has a cabinet of ministers and a privy council. The government is regularly organized, its departments are efficiently managed, and the laws are justly administered. Many of the principal offices are filled by foreigners, chiefly Americans, who have become Hawaiian subjects.

The ancient idolatrous religion has been abandoned since 1819, and the whole population has embraced Christianity. All forms are tolerated, and at Honolulu there are six churches belonging to the Roman Catholic, Protestant Episcopal, and Congregational communions. The bishop of the Church of England is styled the bishop of Honolulu, and the Roman Catholics have also a bishop. The Congregationalists are most numerous. Originally started by the foreign missionaries, the question of education has been taken up by the government.

The number of merchant vessels entered in 1887 was 254, of 210,703 tons, against 310, of 222,372 tons in 1886; 174 of these vessels sailed under the American

flag. The mercantile marine in 1887 counted fifty-seven vessels, including fifteen steamers. The aggregate tonnage was 12,244.

The budget is voted every two years. In that for 1886-88 the receipts are estimated as follows: Customs, \$932,066; internal commerce, \$226,842; internal imports, \$766,422; fines, fees, etc., \$92,299; sales of government property, \$513,732; loans, \$1,811,800; postal savings bank, \$319,933; miscellaneous, \$149,482; total, \$4,812,576.

The expenditures voted under the various heads were as follows: Civil list and appanages, \$137,892; Legislative Assembly and Privy Council, \$60,284; justice, \$154,566; foreign affairs, \$257,996; interior, \$1,204,214; finances, \$727,264; police, etc., \$279,819; instruction, \$165,913; board of health, \$247,907; miscellaneous, \$1,476,430; total, \$4,712,285.

By virtue of a law signed on September 1, 1886, a debt of \$2,000,000 was contracted in London at six per cent. interest, in order to pay off anterior loans. The capital of the debt on April 1, 1888, was \$1,936,500.

Only thirty-two miles of railroad were in operation in 1887, comprising a line from Mahukona across the district of Kohala, twenty miles in length, and one from Hilo to Waiakea, five miles long, both in the island of Hawaii, and another from the port of Kahulani to Husku and Makawao, on the island of Maui, about seven miles in length. The extension of the line on the island of Hawaii to four times its present length is in contemplation, and a subsidy has been voted by the Legislature.

There were in operation in 1886 thirty-one post-offices, which forwarded 233,872 letters and postal cards, and 181,520 newspapers and sample packages, the receipts being \$13,850, and the expenses \$27,443.

The first telegraph line, forty miles in length, was opened from Wailuku to Lahaina on Maui in 1878, and has since been extended over the entire surface of the island. There are 100 miles of telegraph on the island of Oahu, and ninety miles between Hilo and Kawaihae on the island of Hawaii, besides lines on the other principal islands. Nearly every house and place of business in Honolulu has a telephone.

Honolulu (population, 20,487), the capital of the island group, stands on the southwest coast of Oahu, at the mouth of the valley of Nuuanu, which runs back between tall cliffs to two peaks about 3,000 feet high in the great eastern range of mountains. It is the seat of the central government and the residence of the king.

HAWARDEN, a market-town of Flintshire, North Wales, eight miles southwest of Chester, is a clean and tolerably well-built place, situated on an eminence commanding an extensive prospect. It lies in the midst of a coal district, and near it are valuable clay-beds. Coarse earthenware draining-tiles, and fire-clay bricks form the chief manufactures of the district. Population of the township, 6,782; of the parish (including Saltney), 8,683. In the neighborhood is Hawarden Castle, built in 1752, and added to and altered in the Gothic style in 1814; it stands near the ruins of the old castle of that name which was granted by the Conqueror to his nephew Hugh Lupus, and which after many vicissitudes came into the possession of Sergeant Glynne, lord chief-justice of England under Cromwell. On the death in 1874 of Sir Stephen R. Glynne, the last of a line of baronets, the castle passed to his brother-in-law, the eminent statesman Mr. W. E. Gladstone.

HAWES, STEPHEN, a minor English poet of the sixteenth century. Neither the date of his birth nor that of his death has been ascertained.

HAWES, WILLIAM (1785-1846), an English musician of some merit, is remembered chiefly by the fact

that through his instrumentality Weber's *Der Freischütz* was for the first time performed in England. This event took place July 24, 1824, and led eventually to Weber's removal to London.

HAWFINCH, a bird so called from the belief that the fruit of the hawthorn forms its chief food, one of the largest of the Finch family, and found over nearly the whole of Europe, in Africa north of the Atlas, and in Asia from Palestine to Japan. In coloration it bears some resemblance to a Chaffinch, but its much larger size and enormous beak make it easily recognizable, while on closer inspection the singular bill-hook form of some of its wing-feathers will be found to be very remarkable. Though not uncommonly frequenting gardens and orchards, in which as well as in woods it builds its nest, it is exceedingly shy in its habits, so as seldom to afford opportunities for observation.

HAWICK, a municipal and parliamentary borough of Roxburghshire in Scotland, ten miles southwest of Jedburgh, and fifty-three miles south-southeast of Edinburgh, situated on the south bank of the Teviot at its junction with the Slitrig, a wild and irregular stream that flows through the town.

The manufactures of Hawick are mentioned in the burgh records so far back as 1640, but they must have been flourishing for some time before that, as the weavers already formed an important part of the population. The manufacture of tweeds is the most important industry of Hawick. In this branch the annual turn-over is about £800,000; while in the whole woolen trade it is about £2,000,000. The manufacture of hosiery, to which the town owes so much of its prosperity, was introduced in 1771, when four looms, employing six men and five women, produced annually about 2,400 pairs of coarse stockings. Hawick has gradually become the chief seat of this trade in Scotland. Pop. (1890), 16,000.

HAWK, a word of somewhat indefinite meaning, being often used to signify diurnal Birds-of-prey, which are neither Vultures nor Eagles, and again more exclusively for those of the remainder which are not Buzzards, Falcons, Harriers, or Kites. Even with this restriction it is comprehensive enough, and will include more than a hundred species, which have been arrayed in genera, varying in number from a dozen to above a score, according to the fancy of the systematizer. Speaking generally, Hawks may be characterized by possessing comparatively short wings and long legs, a bill which begins to decurve directly from the cere (or soft bare skin that covers its base), and has the cutting edges of its maxilla (or upper mandible) sinuated, but never notched. To these may be added as characters, structurally perhaps of less value, but in other respects quite as important, that the sexes differ very greatly in size, that in most species the irides are yellow, deepening with age into yellow, or even red, and that the immature plumage is almost invariably more or less striped or mottled with heart-shaped spots beneath, while that of the adult is generally much barred, though the old males have in many instances the breast and belly quite free from markings. Nearly all are of small or moderate size—the largest among them being the GOS-HAWK and its immediate allies, and the male of the smallest, *Accipiter tinus*, is not bigger than a Song-Thrush. They are all birds of great boldness in attacking a quarry, but if foiled in the first attempt they are apt to leave the pursuit. Thoroughly arboreal in their habits, they seek their prey, chiefly consisting of birds (though reptiles and small mammals are also taken), among trees or bushes, patiently waiting for a victim to show itself, and gliding upon it when it appears to be unwary with a rapid swoop, clutching it in their talons, and bearing it away to eat it in some convenient spot.

In Europe there are two species—first, *A. nisus*, the common Sparrow-Hawk, which has a wide distribution from Ireland to Japan, extending also to northern India, Egypt, and Algeria, and secondly, *A. brevipes* (by some placed in the group *Micronisus*, and by others called an *Astur*), which only appears in the southeast, and the adjoining parts of Asia Minor and Persia. In North America the place of the former is taken by two very distinct species, a small one, *A. fuscus*, usually known in Canada and the United States as the Sharp-shinned Hawk, and Stanley's or Cooper's Hawk, *A. cooperi* (by some placed in another genus, *Cooperastur*), which is larger, and has not so northerly a range. In South America there are four or five more, including *A. tinus*, before mentioned as the smallest of all, while a species not much larger, *A. minullus*, together with several others of greater size, inhabits South America.

HAWKE, EDWARD HAWKE, BARON, an English admiral, was born in 1705. He entered the navy at an early age, and in 1733 became commander of the *Wolf*. In the engagement off Toulon in 1744, he broke from the line of battle in order to engage the *Poder*, and although he succeeded in causing her to strike her colors, his breach of discipline was punished by dismissal from the service. He was, however, almost immediately restored by the king's command, and in 1747 was promoted to the rank of rear-admiral of the white. In October of the same year he was sent in command of a squadron intended to intercept a fleet of merchant vessels bound for the West Indies under a convoy of nine men-of-war, and coming up with them on the 14th of the month near the isle of Aix, he succeeded, after a severe struggle, in capturing six of the men-of-war, but darkness coming on before the close of the contest, the whole of the merchant vessels escaped. For his victory Hawke was created a knight companion of the Bath. In December of the same year he was chosen member of parliament for Bristol. In May, 1748, he became vice-admiral of the blue, and in January, 1755, admiral of the white. In the following year he succeeded Admiral Byng as commander of the fleet in the Mediterranean, but arrived too late to succor Minorca; and in none of the commands which he subsequently held did he have an opportunity of distinguishing himself till 1759, when he took charge of a squadron sent to cruise off Brest. On the morning of November 20th he sighted the French fleet under Admiral Conflans off Belleisle, and notwithstanding that the French, trusting to their knowledge of the rocks and shallows, retired toward the shore, he determined to engage them, which he did with such impetuosity that their fleet was only saved from total destruction by the approach of nightfall. As it was, more than half their vessels were either disabled, captured, or driven on shore. For this brilliant victory, Hawke received the thanks of the house of commons and a pension of £2,000 per annum. In 1765 he was appointed vice-admiral of Great Britain and first lord of the admiralty. In 1776 he was raised to the peerage by the title of Baron Hawke of Towton. He died at Shepperton, Middlesex, October 17, 1781.

HAWKESWORTH, JOHN (c. 1715–1773), an author of the last century, was born in London. In 1744 he succeeded Dr. Johnson as compiler of the parliamentary debates for the *Gentleman's Magazine*. Eight years later he started, in company with Johnson, Bathurst and Wharton, a periodical called the *Adventurer*. In 1761 he published a volume of fairy tales, and an edition of Swift's works and letters, with a life prefixed which Johnson has referred to in highly laudatory terms in his *Lives of the Poets*. The reputation he obtained by these and other works was such

that he was commissioned by Captain Cook to edit his papers relative to his first voyage. The work appeared in 1773 in three volumes, and as a reward of his labors, Hawkesworth received from the government the sum of £6,000.

HAWKINS, SIR JOHN (c. 1532–1595), was born in Plymouth about 1532, and was bred a sailor. Learning that negroes from the coast of Guinea were good merchandise for traffic in the West Indies, he made trial of this in three voyages, the first in 1562, the second in 1564. The third, made in company with young Drake, in 1567, ended in disaster, the story of which is related by Hawkins himself. He was returned member of parliament for Plymouth in 1572; and the next year he was made treasurer and comptroller of the navy. In the expedition against the Armada he was appointed vice-admiral, hoisting his flag on board the *Victory*, and for his services on that occasion he was afterward knighted. His last expedition (1595) was undertaken, once more with Drake, mainly with a view to rescue his son Richard, who three years before had fallen into the hands of the Spaniards off the coast of Quito. It was unsuccessful; and, worn out with fatigue and broken-hearted, he died off Puerto Rico on November 12, 1595. Hawkins was the first to use chain pumps and fighting nettings for ships.

HAWKINS, SIR JOHN (1719–1789), will be permanently remembered as the author of an important work on the history of music.

HAWKWOOD, SIR JOHN (ob. 1394), an English adventurer who attained wealth and renown by his services as a condottiere in the Italian wars of the fourteenth century.

HAWTHORN, *Cratægus*, L., a genus of plants of the natural order *Rosaceæ* and sub-order *Pomeæ*. The common hawthorn, termed also whitethorn, quickthorn, quickset, and May tree, May bush, or May, *C. Oxyacantha*, L., is a shrub or small tree having a smooth blackish bark; numerous branches, beset usually with thorns, which represent aborted twigs; alternate, long-stalked, obovate-wedge-shaped, three or five-lobed, incised or serrate smooth leaves; flowers sweet-scented, arranged in corymbs, and having caducous bracts, broad, white, pink, or scarlet petals, and one to three styles; and fruit or "haw" an oblong or nearly globular mealy pome, commonly dark red, but occasionally yellow, black, or even greenish orange or dull white, and of one to two cells. The common hawthorn is a native of Europe as far north as 60½° in Sweden, and of North Africa, Western Asia, and Siberia, and has been naturalized in North America and Australia.

HAWTHORNE, NATHANIEL, author, born in Salem, Mass., July 4, 1804; died in Plymouth, N. H., May 18, 1864. He was of Puritan ancestry, his ancestor, William Hathorne, emigrating from Wiltshire, England, in 1630. His father was a sea captain and died when the boy was four years old. Young Hawthorne was a shy and sensitive child, loving solitude and books, and of delicate health. He was educated at private schools, and in 1821 entered Bowdoin College, from which he graduated four years later. Franklin Pierce, Longfellow, and John S. C. Abbott were among his college mates, and their associations were continued through life. Hawthorne read everything he could get hold of; edited a little weekly paper, and wrote some poor verses and a sketch or two of no great merit while at college. His genius matured slowly and for several years, although he wrote a great deal, it was only to destroy the manuscripts unpublished. In 1826 he issued a novel called *Fanshawe*, which he afterward suppressed. Then he wrote short tales, and sketches for newspapers and magazines, continuing his secluded course of life,

and being little known outside of his country home. In 1830 he published some of his *Twice Told Tales*, and during the next seven years edited a magazine and compiled a *Universal History*, being paid \$100 for the last-named. In 1837 the first series of *Twice Told Tales* was issued at Boston, and reviewed favorably by Longfellow in the *North American Review*. Hawthorne was given a position in the Boston custom-house in 1839, by his old friend Geo. Bancroft, and remained there two years, doing no literary work in that time. The Brook Farm experiment attracted him in 1841, and for some months he was a member of that community, where he acquired the materials for the *Blithedale Romance*. In July, 1842, he married Susan Peabody, of Salem, Mass., and went to live with his bride in the old parsonage at Concord, which he immortalized in his *Mosses from an Old Manse* (1846). In 1846 he was appointed surveyor of the Port of Salem, which position he held three years. In his introduction to the *Scarlet Letter* he gives an interesting account of his life and his associates there. The *Scarlet Letter* was published in 1850, and met with unanimous approval. The first edition of 5,000 copies was exhausted at once, and the book was immediately reprinted in England. The lonely student had found his vocation at last, and with it had found fame. His reputation was enhanced by the publication in the following year of *The House With the Seven Gables* and *The Blithedale Romance*.

Hawthorne was a Democrat in politics, and in August, 1852, published a campaign life of his old college friend, Franklin Pierce. In 1853 President Pierce repaid the service by the appointment of his biographer to the consulate at Liverpool, a lucrative office which afforded Hawthorne the opportunity of studying English life and manners, and of visiting the continent of Europe. He wrote while in England *English Note Books; Our Old Home; and French and Italian Note Books*, and in 1860 published the *Marble Faun* in Boston, with an English edition under the title of *Transformation*. Hawthorne returned to the United States at the beginning of the civil war, and contributed articles to the *Atlantic Monthly* and other magazines. His *Septimius Felton* and *Doctor Grimshaw's Secret*—the latter unfinished—were not published until after his death. He began to fail in health in the spring of 1864, and died while on a trip to the White Mountains with ex-President Pierce. He was buried in Sleepy Hollow cemetery at Concord, where rest also the ashes of Emerson and Thoreau. Mrs. Hawthorne survived until 1871, and edited her husband's note-books after his death. A daughter, Una, died unmarried; another, Rose, married George Parsons Lathrop; and a son, Julian, born in Boston, June 22, 1846, is well known as a novelist and sketch writer.

HAXTHAUSEN, AUGUST FRANZ LUDWIG MARIA VON, baron of Haxthausen-Abbenburg, was born in 1792. Educated at first at home, he proceeded in 1811 to the school of mining at Clausthal, in the Harz, and after serving in the Hanoverian army in 1813-15, entered the university of Göttingen. In 1836 he received the honorary title of privy state-councilor, and afterward of hereditary chamberlain of the principality of Paderborn. In 1847-48 he sat as a member of the combined diet at Berlin, and afterward of the first Prussian chamber. After traveling through a large part of Europe, Baron Haxthausen retired to his estate. He died at Hanover, January 1, 1867.

HAYDN, JOSEPH, one of the most celebrated composers of the eighteenth century, was born at Rohrau, a village in Lower Austria, March 31, 1732. Having developed an agreeable soprano voice, young Haydn was, by the intercession of the dean of Hainburg, pro-

moted to a post among the choir boys of St. Stephen's cathedral, Vienna, where he remained from 1740-50. As a composer, Haydn was in every sense self-taught. Of his zeal in acquiring information he was in the habit of talking with pride in later years, and several works of sacred music were the first fruit of his early studies. In 1749 or 1750 his beautiful boyish voice changed, and he lost his position accordingly. Being now thrown on his own resources, he had to undergo various forms of musical drudgery, such as giving lessons (at the moderate stipend of two florins per month) and playing in the orchestra at dances and the like. His condition was somewhat improved by his acquaintance with Metastasio, the celebrated operatic poet, in fact the Scribe of the eighteenth century, who introduced him to Señor Martinez, a Spaniard living in Vienna, whose daughter Haydn instructed for several years. It was through Metastasio also that Haydn came into contact with Porpora, the composer, best known as the singing-master of the great Farinelli. An important event in Haydn's life was his acquaintance with Baron Fürnberg, an accomplished amateur, for whose private concerts he wrote his first string quartet, a form of composition in which he earned some of his greatest and most permanent triumphs. It is in the key of B flat, and was followed in rapid succession by seventeen other works of the same class, written during the years 1755 and 1756. To his new protector Haydn also owed his still more important acquaintance with Count Ferdinand Morzin. Count Morzin in 1759 appointed him conductor of his band. The opportunities of hearing his own works performed by competent musicians Haydn did not neglect, and his first symphony in D belongs to the year 1759. Soon afterward Count Morzin was compelled to dissolve his band, but Haydn's position was by this time sufficiently established, and very soon afterward he found employment as second chapel-master to Prince Paul Esterhazy, one of the richest Austrian nobles, whose love of art was as great as his wealth. The Esterhazy family have been among the foremost patrons of music in Vienna from the days of Haydn to those of Beethoven and Schubert. Prince Paul died in 1762, and left his title and fortune to his brother Nicholas, surnamed the Magnificent. He immediately enlarged his orchestra, and also increased the salaries of its members, including that of Haydn (from 400 to 600 florins), and on the death of his colleague Werner, appointed him first conductor. This position, or at least its title and emoluments, Haydn retained till his death, and his attachment to the Esterhazy family remained unchanged by his subsequent fame and fortunes. The events just referred to determined Haydn's career for the next twenty-eight years. During this period he was in the active service of his protector, residing at Esterházy, the splendid country seat of the family, described as a second Versailles, or in Vienna, conducting the orchestra of the prince, and writing for his concerts and theater a number of works, including symphonies, cassations, quartets, sonatas and numerous vocal compositions, including several operas, none of which, however, had any permanent success. Haydn at an early age became attached to the daughter of a hairdresser, Keller by name, and after her death was persuaded to marry her sister, three years older than himself. The marriage was an unhappy one, and the pair separated soon after their union, Haydn's inflammable heart subsequently causing him more or less serious trouble on more than one occasion. In the meantime the composer's fame had begun to spread from an early period of his career. As early as 1766 a journal speaks of him as the "favorite of the nation," and foreign countries were not slow

in acknowledging his merits. Thus one of his works, *The Seven Words of our Saviour on the Cross*, a series of orchestral interludes for the church service on Good Friday, was written by special invitation for the cathedral of Cadiz. In Paris his works were performed with immense success at the Concert Spirituel, and a single English firm bought the copyright of no less than one hundred and twenty-nine of his works, including eighty-two symphonies. The appreciation of Haydn's work in England led to important results in his latter years. Several pressing invitations to visit that country had been declined by the composer on account of his services being required at Esterházy. But, when in 1790 Prince Nicholas died, and his successor dissolved the orchestra, allowing Haydn a considerable pension, the latter was at last at liberty to accept a munificent offer from Salomon, the violinist and entrepreneur, in whose company he started for London.

Haydn's visit to London was a succession of triumphs. Doctor Burney welcomed him with a laudatory poem; the various musical societies of the metropolis vied for his presence; and on July 8, 1791, he was created doctor of music by the university of Oxford. At court also he was received with distinction. Haydn's engagement with Salomon was to write and conduct at the concerts in the Hanover Square Rooms six symphonies. The symphonies known as the "Salomon Set," comprising some of Haydn's finest instrumental works, are the permanent record of the connection of the two artists. In 1792 Haydn also went to hear the charity children at St. Paul's, whose singing produced on him as deep an impression as it did on Berlioz many years later. Haydn left London in June, 1792, but only to return in January, 1794. In addition to his earlier works six new symphonies were played at the concerts of Salomon, which in the following year were given at the King's Concert-room and terminated on June 1, 1795, when Haydn appeared for the last time in England. He realized \$6,000 by his second English visit, from which he returned to Vienna in the autumn of 1795, to resume once more his functions in the newly organized chapel of Prince Esterházy. The two works on which — apart from his symphonies and sonatas — his immortality must mainly rest, belong to this last epoch of his life. These were the oratorio *The Creation*, and the cantata *The Seasons*. They were both written to German translations of English libretti, the former being compiled from *Paradise Lost*, the latter from Thomson's *Seasons*. *The Creation* was first performed in public on March 19, 1799, when its success was as immediate as it has since proved permanent. *The Seasons* was begun soon after the completion of *The Creation*, and finished in very little time. Haydn died on May 31, 1809, during the occupation of Vienna by Napoleon's army.

Two of Haydn's brother's acquired a certain amount of celebrity. JOHN MICHAEL HAYDN, born at Rohrau, September 14, 1737, and like his brother a choir-boy at St. Stephen's cathedral, became a prolific and able composer of masses and all kinds of church music. He lived during the greater part of his life at Salzburg, and his name is frequently mentioned in the biography of Mozart. Of his numerous compositions few have been printed. A mass in D is perhaps his masterpiece. He died August 20, 1806. The youngest brother, JOHANN HAYDN (born December 23, 1743, died May 20, 1805), had some reputation as a vocalist, and became, most probably by his brother's intercession, a singer in Prince Esterházy's chapel.

HAYDON, BENJAMIN ROBERT, historical painter and writer, was born at Plymouth, January 26, 1786. At an early date he gave evidence of his taste for study,

which was carefully fostered and promoted by his mother. At the age of twenty-one (1807) Haydon exhibited, for the first time, at the Royal Academy, *The Repose in Egypt*, which was bought by Mr. Thomas Hope the year after. This was a good start for the young artist, who shortly received a commission from Lord Mulgrave and an introduction to Sir George Beaumont. In 1809 he finished his well known picture of *Dentatus*, which, though it brought him a great increase of fame, involved him in a life-long quarrel with the Royal Academy, whose committee had hung the picture in a small side-room instead of the great hall. In 1810 his difficulties began through the stoppage of an allowance of £200 a year he had received from his father. His disappointment was embittered by the controversies in which he now became involved with Sir George Beaumont, for whom he had painted his famous picture of *Macbeth*, and Mr. Payne Knight, who had denied the beauties as well as the value of the Elgin Marbles. *The Judgment of Solomon*, his next production, gained him £700, besides £100 voted to him by the directors of the British Institution, and the freedom of the borough of Plymouth. Haydon joined his intimate friend Wilkie in a trip to Paris; he studied at the Louvre; and, on his return to England, produced his *Christ's Entry into Jerusalem*, which afterward formed the nucleus for the American Gallery of Painting, which was erected by his cousin, John Havilland, of Philadelphia. In 1823 Haydon was lodged in the King's Bench, where he received consoling letters from the first men of the day. While a prisoner he drew up a petition to parliament in favor of the appointment of "a committee to inquire into the state of encouragement of historical painting," which was presented by Mr. Brougham. He also, during a second imprisonment, in 1827, produced the picture of the *Mock Election*, the idea of which had been suggested by an incident that happened in the prison. The king (George IV.) gave him £500 for this work. Among Haydon's other pictures were: 1829, *Eucles*, and *Punch*; 1831, *Napoleon at St. Helena*, for Sir Robert Peel; *Xenophon, on his Retreat with the "Ten Thousand," first seeing the Sea*; and *Waiting for the Times*, purchased by the marquis of Stafford; 1832, *Falstaff*, and *Achilles Playing the Lyre*. In 1834 he completed the *Reform Banquet* for Lord Grey — this painting contained 197 portraits; in 1843, *Curtius Leaping into the Gulf*, and *Uriel and Satan*. When the competition took place at Westminster Hall, Haydon sent two cartoons, *The Curse of Adam*, and *Edward the Black Prince*, but had not the good fortune to gain a prize for either. He then painted *The Banishment of Aristides*, which was exhibited with other productions under the same roof where Tom Thumb was then making his début in London. The exhibition was unsuccessful; and the artist's difficulties increased to such an extent that, while employed on his last grand effort, *Alfred and the Trial by Fury*, overcome by debt, disappointment, and ingratitude, he wrote "Stretch me no longer on this rough world," and put an end to his existence with a pistol-shot, June 22, 1846, in the sixty-first year of his age.

HAY FEVER, HAY ASTHMA, or SUMMER CATARRH, a term applied to a catarrhal affection of the respiratory mucous membrane occurring in some individuals during the hay season, and generally believed to be due to the inhalation of the emanations from the spring grass. It is an ailment of comparatively rare occurrence. The symptoms are those commonly experienced in the case of a severe cold or influenza, consisting of headache, violent sneezing, and watery discharge from the nostrils and eyes, together with dry hard cough, and occasionally severe asthmatic paroxysms. The attack usually runs a

course of from two to six weeks, unless cut short by appropriate treatment, to which the complaint is in a considerable measure amenable. There is generally an annual recurrence of the disorder in those liable to it if they are exposed to its exciting cause, namely, the presence of hay. Symptoms of a similar character are produced in certain persons by the aroma of various flowers, by ipecacuanha, and by the odor from cats, dogs and rabbits. The best preventive of or treatment for the disorder is a removal from the neighborhood of the exciting cause. If, however, medical treatment becomes necessary, the best remedies are: for the cough, muriate of ammonia in connection with salycin, made into a pill containing three grains each of the two substances with a half grain of liquid pitch (wood tar), taken by an adult three or four times daily; for asthmatic symptoms the smoking of stramonium (Jamestown weed) leaves is recommended, or the hypodermic injection of opium, or the employment of emetics (which by their nauseating effect relax the pectoral muscles and admit of easier respiration), or extract hyoscyamus (henbane) in small, often repeated doses. For the nasal flow a solution of boracic acid, or sulphate of quinine, or carbolic acid, applied as a nasal douche. In the meantime the general health should be looked to, and administration of quinine and iron or other tonics and antiperiodics is indicated.

HAYLEY, WILLIAM, the friend and biographer of Cowper, was born in Chichester, in England, 1745. Hayley made more than one attempt to succeed as a dramatic author, but first won fame by his political *Essays on Painting, History, and Epic Poetry*, and by his poem the *Triumph of Temper*. On the death of Warton, Hayley was offered the laureateship, but declined it. In 1792 he made the acquaintance of the poet Cowper; and this acquaintance ripened into a friendship which remained unbroken until Cowper's death in 1800. Hayley died in 1820.

HAYNE, ROBERT YOUNG, statesman, was born in St. Paul's parish, Colleton district, South Carolina, on November 10, 1791. He studied law at Charleston, S. C., and in his twenty-first year was admitted to the bar there, but in the same year (1812) served for a short time as a soldier in the war with Great Britain. Returning to practice in Charleston, Hayne was elected a member of the State legislature in 1814, and four years later became speaker. Shortly afterward he accepted the post of attorney-general for his native State, though he declined the same office for the United States. On being elected a senator of the United States, Hayne at once showed himself an active foe to protective legislation, and vigorously combated the tariffs of 1824 and 1828. A bill having been passed in 1832 removing the duty from those imports only which were not in competition with home manufactures, the State of South Carolina passed an ordinance nullifying the bill, on the ground that it was unconstitutional. President Jackson denounced this proceeding, and South Carolina appointing Hayne governor, was preparing to defend its position by arms when congress made the desired change in the tariff, and South Carolina repealed its act. Hayne, on retiring from the governorship in 1834, was elected mayor of Charleston, and continued to take an active interest in public affairs till his death at Asheville, N. C., September 24, 1840.

HAYTER, SIR GEORGE (1789-1871), principal painter in ordinary to the queen, was the son of a drawing master and teacher of perspective who published a well-known introduction to perspective and other works. He painted various works on a large scale of a public and semi-historical character, but essentially works of portraiture; such as *The Trial of Queen Caroline* (189 likenesses), *The Meeting of the First Reformed Par-*

liament, now in the National Portrait Gallery, *Queen Victoria Taking the Coronation Oath* (accounted his finest production), *The Marriage of the Queen* and the *Trial of Lord William Russell*.

HAYTI, or HAÏTI, the largest island of the West Indian group, with the exception of Cuba. It is 400 miles long, and from 60 to 150 miles in width. The island is divided into two governments, that of Hayti in the west, and Santo Domingo (*q.v.*) in the east. Hayti contains about 9,000 square miles, and has a population of over half a million, almost all negroes. It is a mountainous country, well watered and heavily timbered. The climate is tropical and unhealthy, and the soil is fertile. The rainy season covers May and June. The chief occupation of the inhabitants is agriculture, mining being neglected, although various minerals are found. Coffee, sugar and lumber, principally mahogany and logwood, are exported. There is little trade, and the condition of the people is degraded. Port-au-Prince is the capital, and there are few other cities of any importance.

Hayti was discovered by Columbus in 1493, and the Spaniards made on its northern coast the first permanent colony of Europeans in the New World. In 1665 France obtained a foothold on the island. In 1800 the French were driven out by the blacks, and Hayti became a republic. Revolutions and military pronunciamientos followed, and, in 1849, an empire was constituted, which again gave place to a republic in 1858. There is now an elective president, with almost despotic powers, and a national assembly, consisting of a senate and house of representatives. The republic is deep in debt, and its annual expenditures exceed its receipts. The established religion is Roman Catholic, but other creeds are tolerated.

HAYWARD, SIR JOHN (*c.* 1560-1627), one of the earliest writers of English history as distinguished from the old chroniclers, was born near Felixstow on the coast of Suffolk. In 1599 he published *The First Part of the Life and Raigne of King Henrie the III.*, extending to the end of the first yeare of his raigne, which, from its dedication to the earl of Essex, and a passage it contained on hereditary rights, led to the author's imprisonment by Elizabeth.

HAZÁRA, or HUZARA, a British district in the lieutenant-governorship of the Punjab, India. The area is 2,771 square miles. Population, 400,000. The district forms a wedge of territory extending far into the heart of the outer Himalayan range, and consisting of a long narrow valley, shut in on both sides by lofty mountains, whose peaks rise to a height of 17,000 feet above sea level. The district is well watered by the tributaries of the Indus, the Kunhár, which flows through the Khágán Valley into the Jhílám (Jhelum), and many rivulets. Throughout the scenery is picturesque.

HAZARAS. See AFGHANISTAN.

HAZARD, a game played with dice. The player or "caster" calls a "main" (that is, any number from five to nine inclusive). He then throws with two dice. If he "throws in," or "nicks," he wins the sum played for from the banker or "setter." Five is a nick to five. six and twelve are nicks to six, seven and eleven to seven, eight and twelve to eight, and nine to nine. If the caster "throws out" by throwing aces, or deuce, ace (called crabs), he loses. When the main is five or nine the caster throws out with eleven or twelve; when the main is six or eight he throws out with eleven; when the main is seven he throws out with twelve. If the caster neither nicks nor throws out, the number thrown is his "chance," and he keeps on throwing till either the chance comes up, when he wins, or till the main comes up, when he loses. When a chance is thrown, the

"odds" for or against the chance are laid by the setter to the amount of the original stake.

HAZÁRIBÁGH, a British district in the lieutenant-governorship of Bengal, India, is bounded on the north by the districts of Gayá and Monghyr, on the east by the Santál Parganás and Mánbhúm districts, on the south by Lohárdagá, and on the west by Lohárdagá and Gayá; it forms the northeast portion of the Chutiá Nágpur division, and has an area of 7,020 miles, and a population of 800,000. A high central plateau occupies the western section, the surface of which is undulating and cultivated; a lower and more extensive plateau stretches along the north and eastern portions; to the north, the land is well cultivated, while to the east the country is of a more varied character, the elevation is lower, and the character of a plateau is gradually lost; the central valley of the Dámodar river occupying the entire southern section. Indeed, although the characteristics of the district are rock, hill, and wide-spreading jungle, fine patches of cultivation are met with in all parts, and the scenery is generally pleasing and often picturesque.

HAZÁRIBÁGH, the chief town and administrative headquarters of the above district, is picturesquely situated on the high central plateau of the district, at an elevation of 2,000 feet above the sea-level, and in the midst of a group of conical hills. Population (1890), 13,000.

HAZEBROUCK, a town of France, capital of an arrondissement of the same name in the department of Nord, is situated on the Bourre, thirty-two miles west-northwest of Lille. Population, 7,000.

HAZEL, a genus of shrubs or low trees of the natural order *Cupuliferæ* and sub-order *Coryleæ*. The common hazel is distributed throughout Europe, in North Africa, and in Central and Russian Asia, except the northernmost parts. It is commonly found in hedges and coppices, and as an undergrowth in woods, and reaches a height of some twelve feet; occasionally it may attain to thirty feet. The bark of the older stems is of a bright brown, mottled with gray; that of the young twigs is ash-colored, and glandular and hairy. The leaves are alternate, from two to four inches in length, downy below, roundish-cordate, pointed, and shortly petiolate; occasionally they are found with the margins coherent at the base, or with the disk so depressed as to form a pitcher-like structure. In autumn the rich yellow tint acquired by the leaves of the hazel adds greatly to the beauty of landscapes. The flowers are monœcious, and appear in February or March, before the leaves, and sometimes in October. The cylindrical, drooping, and yellow male catkins are one to two and one-half inches in length, and occur two to four in a raceme; when in unusual numbers they may be terminal in position. The female flowers are small, sub-globose, and sessile, resembling leaf-buds, and have protruding crimson stigmas; the minute inner bracts, by their enlargement, form the palmately lobed and cut involucre or husk of the nut. The ovary is not visible till nearly midsummer, and is not fully developed before autumn. The nuts have a length of from one-half to three-quarters inch, and grow in clusters. Double or treble nuts are the result of the equal development of two or all the three carpels of the original flower, of which ordinarily two become abortive. From the light-brown or brown color of the nuts the terms *hazel* and *hazelly*, *i. e.*, "in hue as hazel nuts" derive their significance. The wood of the hazel is whitish-red, close in texture, and pliant, and has when dry a weight of forty-nine pounds per cubic foot. The nuts are also known as filberts.

HAZFL-HEN. See GROUSE.

HAZLETON, a Pennsylvania mining town, is situ-

ated in Luzerne county, in the midst of a great coal-producing region. The principal business of the town is dependent on the coal industry, the Hazleton mines annually yielding over a million tons output. The town has banks, railroads, telegraphs, churches, and higher and lower schools. A Catholic convent and academy are located here. The municipal government of the town is efficiently administered, and most of the modern improvements and appliances of city life obtain. The community is steadily growing in wealth and population, and the town now (1890 census) contains 11,572 people.

HAZLITT, WILLIAM, one of the most eminent of English critics, was born April 10, 1778, at Maidstone, Kent. He was educated privately, and afterward at the Unitarian college at Hackney, where he first began to speculate upon metaphysical subjects. Feeling disinclined to enter the dissenting ministry, he returned to Wem in Shropshire, where his father had in the meantime settled, and there led an idle and desultory life until, about 1802, he determined upon becoming a painter. He commenced the practice of painting in London, where his elder brother had already acquired some reputation as an artist, and soon found his way into literary and artistic circles, becoming especially intimate with Lamb, Hunt, and Godwin. Previously to this he had (January, 1790) been powerfully influenced by Coleridge. His professional painting did not prosper, and little remains of it except a few portraits; but in 1805 he published his *Essay on the Principles of Human Action*, which had occupied him at intervals for six or seven years. In 1807 appeared a useful abridgment of Abraham Tucker's *Life of Nature Pursued*, and a clever but fallacious attempt to invalidate the natural law established in Malthus' *Essay on Population*. After three or four years, during which he almost disappears from observation, he came forward prominently as a writer in the *Examiner* and as a lecturer at the Surrey institution, bringing out in rapid succession his *Round Table*, a collection of essays on literature, men, and manners, his *View of the contemporary English stage*, and his lectures on the poets, the English comic writers, and the dramatic literature of the age of Elizabeth. By these works, together with his *Characters of Shakespeare's Plays* (1817), and his *Table Talk* (1821), his reputation as a critic and essayist will mainly be sustained. The first reception of his admirable essays was by no means in accordance with their deserts. The *Quarterly* attacked him with deliberate malignity, stopped the sale of his writings for a time, and blighted his credit with publishers. He had become estranged from his early friends, the Lake poets, by what he uncharitably but not unnaturally regarded as their political apostasy; as well as by an escapade of his own, obscurely related, but apparently not creditable. His inequalities of temper separated him for a time even from Leigh Hunt and Charles Lamb. Pecuniary anxieties and disappointments may have contributed to hasten his death, which took place on September 18, 1830.

HEAD, SIR EDMUND WALKER, BART., a popular writer on art, was born in 1805 at Wharton Place, near Maidstone in Kent. He was educated at Winchester school and Oriel college, Oxford, and taking his degree with first-class honors in classics, he became in 1827 fellow of Merton college, and in 1834 university examiner in classics. On his father's death, in 1838, he succeeded to the baronetcy as eighth baronet. He procured in 1847 the office of lieutenant-governor of New Brunswick, whence he passed in 1854 to the governor-generalship of Canada, which he retained till 1861. The following year, having returned to England, Head was nominated a civil-service commissioner. In 1857 he

was sworn of the privy council, and in 1860 was decorated as K.C.B., while in the course of his career he received the degrees of D.C.L. at Oxford and LL.D. at Cambridge. He died in London, January 28, 1868.

HEAD, SIR FRANCIS BOND, BART., soldier, traveler, and author, was born in 1793. He served with the Royal Engineers at the battles of Waterloo and Fleurus, and when he retired from the army he had risen to the rank of major. In 1825 he accepted the charge of an association formed to work the gold and silver mines of Rio de la Plata. In connection with this enterprise, he made several rapid journeys across the Pampas and among the Andes, his *Rough Notes* of which, published in 1826, and written in a clear and spirited style, obtained for him the name of "Gallop Head." In 1835 he was appointed governor of Upper Canada, where he manifested similar energy in dealing with the discontent from which the colony was at that time suffering. He resigned his office in 1837, and in recognition of his services he was in 1838 created a baronet. The narrative of his administration in Upper Canada was published by him in 1839. In 1867 he became a privy councilor. He died at Croydon, July 20, 1875.

HEAD, SIR GEORGE, brother of the preceding, was born in 1782. He was educated at the Charterhouse. In 1808 he received an appointment in the commissariat of the British army in the Peninsula, where he was a witness of many exciting scenes and important battles, of which he gave an interesting account in "Memoirs of an Assistant Commissary-General" attached to the second volume of his *Home Tour*, published in 1837. In 1814 he was sent to America to take charge of the commissariat in a naval establishment on the Canadian lakes, and he subsequently held appointments at Halifax and Nova Scotia. Some of his Canadian experiences were narrated by him in *Forest Scenery and Incidents in the Wilds of North America*, published in 1829. In 1831 he received the honor of knighthood. He published in 1835 *A Home Tour through the Manufacturing Districts of England*, and in 1837 a sequel to it, entitled *A Home Tour through various parts of the United Kingdom*. He also contributed several articles to the *Quarterly Review*, and translated *Historical Memoirs of Cardinal Paca*, 1850, and the *Metamorphoses of Apuleius*, 1851. He died in London in 1855.

HEARNE, SAMUEL, an English explorer, was born at London in 1745. In 1768 he was appointed to examine portions of the coast of Hudson's Bay with a view to the improvement of the codfishing, the discovery of the northwest passage, and of certain mines of copper whose existence was asserted by the Indians. His first attempt, upon which he set out on November 6, 1769, was unsuccessful, owing to the desertion of the Indians; and his second, entered upon on February 23, 1770, was by the breaking of his quadrant likewise rendered abortive; but in his third expedition, upon which he started in December, 1770, he was completely successful, as he not only discovered the existence of copper on the banks of what is now known as Coppermine river, but traced the course of that river till it joined the Arctic ocean. After an absence of eighteen months and twenty-three days he arrived at Fort Churchill, of which he was subsequently promoted to be the governor. He returned to England in 1787, and died there in 1792.

HEARNE, THOMAS (1678-1735), an English antiquary, was born at Littlefield Green, in the parish of White Waltham, Berkshire.

HEART, DISEASES OF THE, form a large proportion of the most serious disorders that afflict mankind, in youth as well as in advanced life.

As in former so in recent times the progress made in

the diagnosis of diseases of the heart has been entirely based on physics and on physiology, and the heart is an organ so situated and so connected as to render it singularly amenable to these methods of investigation. Resting on the diaphragm, and projected against the anterior chest-wall, the heart is partly within reach, and is otherwise so completely surrounded on three sides by resonant organs (the lungs) that any change in its position or in its size is readily made out by palpation and percussion, while by listening over the cardiac area—auscultation—we can ascertain whether the valves of the heart remain intact, have an unusual strain thrown upon them, or have been rendered incompetent by disease.

As the four openings of the heart lie so close together that a superficial area of half a square inch includes a part of each, it is only by taking advantage of certain well-known laws regulating the conduction of sound that we are able to differentiate the sounds produced at each of these openings respectively, and to assign to each a definite position on the chest-wall, where it is heard at its maximum intensity. Physiology, on the other hand, teaches us that each individual cardiac pulsation, the time of which is marked for us by that impulse against the chest-wall of which we are all more or less conscious, consists of alternate acts of contraction and dilatation affecting the four cavities of the heart. Some of these acts precede this impulse, some accompany it, and others follow it, and the relation of any sound produced within the heart to these physiological acts is termed its rhythm.

The organic perfection of the heart is thus easily determined by ascertaining that it is of a normal size, that its impulse is neither too strong nor too weak, and that its sounds are normal when listened to, each in its own position of maximum intensity. When these conditions are present, any abnormal cardiac phenomena, such as palpitation, irregular action, etc., are to be regarded as entirely due to abnormal innervation, and not to any malformation of the heart. On the other hand, organic imperfection is readily detected by the occurrence of abnormality in the phenomena already referred to, especially if accompanied by a blowing sound, instead of the usual valve sound, in any of the normal auscultatory areas. And an intelligent appreciation of these facts, together with a correlation of the physical with the physiological phenomena, that is, a correct determination of the rhythm of the sounds heard, enables us to ascertain with certainty, not only the valve implicated, but also the mode in which the lesion has affected, or is likely to affect, the heart, and through it the circulation. Having found the heart to be functionally deranged, we have two alternatives presented to us—either the valves are incurably deformed from previous disease, or they are merely functionally imperfect from over-distention of the cardiac cavities, a state of matters which may arise from various causes, and which is always susceptible of great relief and very often of perfect cure.

The great function of the heart is to keep up such a pressure within the arterial section of the vascular canals as will suffice for the maintenance of the circulation and of all the organic functions of the body dependent upon it. The tendency, however, of all the extrinsic forces connected with the circulation is to equalize the blood pressure throughout the vascular system, and so to bring the circulation to a stand-still; and indeed it is in this way that death at last occurs; whether it happen suddenly or slowly the cause is still the same—cessation of the circulation brought about by equalization of the blood pressure throughout the whole of the vascular system, or, as it may be otherwise put, from decline of the arterial (aortic) blood pressure.

Valvular lesions of the heart, however produced, tend, as may be readily understood, to neutralize the cardiac function and to lower the arterial blood pressure, either by permitting an unnatural escape of the blood backward (regurgitation), or by obstructing its onward flow (obstruction). And this action is further intensified by the interference with the cardiac nutrition, which necessarily results, first of all directly, from the heart being flushed with blood at a low pressure, and secondly indirectly, from the imperfect performance of all those functions, such as digestion, etc., upon which the formation of healthy blood depends, arising from the same cause.

Valvular disease thus gives the heart more work to do, while it takes from it the power of doing it, putting the organ in a vicious circle. In this way curable disease if neglected may readily lapse into incurability, while to incurable disease there can be but one ending, though, apart from such accidents as embolism or asystole from violent emotion or exertion, that is neither so sudden nor so speedy as is commonly supposed, and indeed usually occurs from gradual asthenia, often accompanied by dropsy, and preceded by a life of more or less active exertion, averaging in many cases not less than twenty years from the primary onset of the disease. During this comparatively long period the disease may have been entirely mute; that is, the valve lesion has progressed so slowly from its trifling commencement that the residual accumulation in the cavity primarily affected has gone on *guttatim*, and has spread itself backward over the other sections of the circulation in the same gradual manner, the resulting dilatation being so immediately followed by compensating hypertrophy that the sufferer has never been aware of any derangement of his functions. A time comes at last, however, when, from a failure of nutrition due to physical causes, the increase in the heart's bulk ceases to be muscular, it becomes fibrous; then indeed the disease is no longer mute, serious rupture of the compensation sets in, and all that art can do is to make the inevitable declension as gradual as possible. Up to this period any accidental rupture of the compensation, which readily enough occurs from over-exertion, imperfect nutrition from any cause, or from any feverish attack, is as a rule perfectly amenable to appropriate treatment, though the restored compensation is always less stable than it had been previously.

Ruptured compensation is often attended by very alarming symptoms, such as great general dropsy and extreme irregularity of the heart's action, but the true measure of the patient's danger lies less in these symptoms than in the condition of the cardiac muscle, and in the circumstances which threaten asystole, that is, arrest of the heart's action.

If in early times the diagnosis of diseases of the heart was a matter of great difficulty, this seemed of less importance, as their treatment was so hopeless. "A mesure qu'on pénètre," says Senac, "dans les maladies du cœur, la médecine paraît plus stérile; que peut-on espérer des médicaments, par exemple, dans les dilatations du cœur?" (The deeper we penetrate into diseases of the heart the more useless medicines prove. What, then, can we hope from medicine, for example, in dilatation of the heart?) But modern science, which has rendered the heart so accessible from all sides that there is nowadays probably no organ of the body whose diseases can be so readily detected or so accurately discriminated, has not only pointed out the true source of danger in these diseases, but has also put into our hands a remedy by which some are cured who were formerly thought incurable, while many incurables have their downward progress so successfully arrested that they feel themselves to be practically cured. And yet DIGI-

TALIS was all but unknown 100 years ago, while so little was known of its real action—*ratio medendi*—that within the last thirty years a living author wrote that the use of digitalis as a diuretic in heart disease was quite "indefensible," as "the failing heart is absolutely incapable of sustaining the depressing influence of the drug." Nor was this all; many writers gravely claiming that the drug was *cumulative* in its action; i.e., it was retained in the system, and all at once, when a certain stage of its administration had been reached, it exhibited its toxic effects—not only as a result of the doses recently taken, but as the combined effect of recent doses with those taken at a remote period of time. Nowadays we know digitalis to be the only drug that can be relied on for increasing the power of the heart's contractions, and it also slows them—the result being that the blood pressure is increased throughout the whole arterial system, and that, time being given for the heart itself to be flushed with blood at an increased pressure, its nutrition is improved. The heart not only acts more powerfully under the immediate influence of the drug, but it becomes more able to act, so that by and by the drug may be left off; though indeed, should the muscular degeneration determinately threaten a rapid progression, tonic doses of the drug may be safely given daily, for many years continuously, in spite of all our forefathers' croaking as to the dangers of accumulation. But however marvelous the effects of tonic doses of digitalis may be, the virtues of the drug in large doses are even more wonderful in appropriate cases, for by means of large doses the skilled physician has it in his power permanently to contract many dilated hearts, and so to cure what seemed an incurable disease not only to Senac but even to many of his more modern successors. Care should be taken, however, to ascertain the exact nature of the valvular lesion of the heart before digitalis is administered, as it may be seriously doubted, whether in cases of regurgitation digitalis can be justified. This affection, usually due to the tardiness in the closing of the ventricle, thus allowing the blood to recede to the cavity of the heart, would seem to be aggravated by the use of any agent which still further tends to slow the motion of the heart. On the other hand, the advocates of digitalis claim that the propulsive power of the heart is so much augmented that the danger is minimized; the question, however, is an open one. The dose of digitalis is usually from five to twenty drops of the tincture, Sixty drops is the maximum, and is rarely administered.

There are many other drugs employed in the treatment of diseases of the heart, but there is no other deserving of special mention. Other medicines are employed to relieve pain, aid digestion, dispel flatulence, unload the bowels, improve the blood, or simply as general tonics, and may be catalogued as morphia, chloroform, belladonna, pepsine, asafoetida, aloes, rhubarb, iron, etc.

ANGINA PECTORIS is a painful disease of the heart which has been already described. *Palpitation* is an extremely rapid and sometimes forcible action of the heart. *Irregular* and *Intermittent Action* are sufficiently described by their names; irregular action may be tumultuous or so peculiar as to deserve the name of a veritable *delirium cordis*; intermission consists in the dropping of a beat every second, third, or fourth time, or seldomer. Sometimes the intermission only applies to the pulse, the heart acting regularly, and is caused by that particular systole not being forcible enough to propel the blood to the periphery; occasionally we have two beats of the pulse, and then an intermission, constituting what has been termed a *pulsus bigeminus*, or the rhythm of the intermission may be even more varied. All these forms of perverted

action of the heart may accompany valvular lesions, or may occur in hearts whose valves are sound; the walls of such hearts are, however, almost invariably more or less feeble, imperfectly nourished, and the blood often poor and watery. They are rarely indicative of any real danger, though sufficiently troublesome and alarming to the sufferer; they arise from abnormal innervation; a flatulent distention of the stomach, a crapulous dyspepsia, the abuse of alcohol and tobacco, etc., are frequent sources of nervous heart trouble, so frequent that in some parts where young men most do congregate the tobacco heart especially is quite a proverbial ailment. Overwork, worry, or excess of any kind is sufficient to bring on heart trouble of this character. Fortunately, to a skilled physician there is no difficulty of determining the true nature of these cases, and they are all more or less amenable to appropriate treatment. *Syncope*, or fainting, is an affection somewhat similar to those just described; it essentially consists in an emotional inhibition of the cardiac systole, so that the blood pressure within the brain falls below that necessary for the maintenance of consciousness; as the heart's action fortunately does not in these cases entirely cease, the best plan is to favor the flow of blood to the head by maintaining the sufferer with a lowered and slightly depending head until the effects of the momentary inhibition have passed off. The inflammatory affections of the heart, *Carditis*, *Endocarditis*, and *Pericarditis*, are most important and serious affections. They are mainly rheumatic and gouty in character, and they are to be regarded as varieties of these diseases; the mere fact of their affecting the heart is of but little consequence as to their immediate result, however important it may by and by become from the valvular lesions to which they so often give rise. There are but few exceptions to this rule, and among them are those rare cases in which acute endarteritis blocks the coronary vessels and gives rise to fatal angina. *Fatty Degeneration* of the heart, which bulks so largely in the popular mind as a cause of sudden death, is an almost hypothetical lesion of most infrequent occurrence, probably never found apart from disease of the coronary arteries, impossible of diagnosis, and very rarely of itself proving suddenly fatal.

HEART-BURIAL, or burial of the heart in a place separate from that in which the body is laid, seems to have been once practiced by the ancient Egyptians. In European countries it was most common in the twelfth and thirteenth centuries, though instances have occurred in all centuries down to and including the nineteenth. The practice undoubtedly arose out of the special veneration in which the heart was held as the seat of the affections and of certain of the higher virtues, as courage, piety. Besides the heart, other parts of the body, such as the viscera, were sometimes honored with separate burial. It has been suggested that this distribution of the body for sepulture was prompted by a wish to secure the prayers of more than one congregation for the soul of the deceased. In other instances, where the deceased has died abroad and his heart has been carried home for burial, the motive is simpler to understand. The persons who have been honored with separate burial for the heart have been for the most part men and women of royal birth and ecclesiastics of high rank. Among royal personages may be enumerated Henry I. and Richard I. of England, whose hearts were interred at Rouen; Henry III., whose heart was buried at Fontevraud in Normandy; Eleanor, wife of Edward I., at Lincoln; Edward I. himself whose heart was sent to Jerusalem for burial, as was that of ROBERT BRUCE (*q. v.*); the French kings, Louis XII., XIII. and XIV., Francis I. and II., and Henry

II. and III.; the Emperor Leopold of Austria; and James II. of England, whose heart was entombed in St. Mary of Chaillot near Paris. The heart of Anne de Montmorency, constable of France, was interred at Les Célestins; that of Lord Edward Bruce at Culross Abbey in Perthshire, his body in Bergen-op-Zoom in Holland; and that of Sir William Temple at Moor Park near Farnham. The viscera of the popes from Sixtus V. (1590) onward were interred in SS. Vincenzo and Anastasio, the parish church of the Quirinal. In the nineteenth century the best-known cases are those of Daniel O'Connell, the poet Shelley (*"cor cordium"*), and Kellermann, the French marshal. The hearts of the first two were buried in Rome, that of the last on the battlefield of Valmy. The practice was prohibited by Pope Boniface VIII. (1294-1303) under sentence of excommunication; but the prohibition was removed by his successor Benedict XI., at all events so far as the French royal family was concerned. See Pettigrew, *Chronicles of the Tombs* (1857), pp. 249 *et seq.*

HEARTH-MONEY, an unpopular tax of two shillings levied on every hearth in all houses "paying to church and poor;" first imposed in 1663, and abolished in 1689.

HEART'S CONTENT, a port of Newfoundland, on the east side of Trinity Bay, with 900 inhabitants. Two Atlantic cables land here.

HEAT, the cause of the sensation of warmth, and of a multitude of common phenomena in nature and art. In considering this subject scientifically it is necessary from the outset to discard the ideas conveyed by the popular use of such words as hot and cold. A number of bodies, however different, left for a long enough time in the same room, must, as we shall see further on, acquire the same *temperature*, or become in reality equally warm. Yet in popular language, some, as metals, stones, etc., are pronounced to be cold, and others, as flannel and fur, warm. The touch, then, is *not* a means by which we can acquire any definite idea of the temperature of a body.

Nature of Heat.—A heated body is no heavier than it was before it was heated; if, therefore, heat be a material substance, as it was long considered, it must be *imponderable*. And, in fact, under the name of caloric, it is classed in almost all but modern treatises as one of the family of imponderables. But if it were *matter*, in any sense of the word, its quantity would be unchangeable by human agency. Now we find that there are cases in which heat is produced in any quantity without flame, combustion, etc., as in melting two pieces of ice by rubbing them together, and also cases in which a quantity of heat totally disappears. This is utterly inconsistent with the idea of the materiality of heat. The only hypothesis that at all accords with the phenomena is that *heat depends upon motion of the particles of a body*, being in fact Energy, not Matter; and with this idea we shall start.

Temperature.—When two bodies are placed in contact, heat will in general pass from one to the other, with the effect of cooling the first and warming the second. This process goes on until the two acquire the same temperature. Thus temperature is a condition of a body, determining, as it were, the *head* of the heat which the body contains—to take the obvious analogy of water in a cistern or a mill-pond. In this sense it is analogous also to the pressure of gas in a receiver, or to the potential in an electrified conductor. By the help of the "specific heat" of bodies (which will be treated later) we can determine from their change of temperature how much heat they gain or lose. The scientific or *absolute* measurement of temperature can only be alluded to here. See THERMO-DYNAMICS.

Measure of Heat.—Whether it be a vibration, such as light and sound (as in some cases it certainly is), or consist in independent motions of the particles of a body, leading to a succession of *impacts* on each other and on the walls of the containing vessel (as is almost certainly the case in gases), it is none the less certain that the *amount* of heat in a body is to be measured by the energy of moving particles. But as we cannot observe those particles so as to ascertain their vis-viva, we must have as a preliminary some artificial unit in terms of which to measure heat. This will be described later. But in order that this process may be applied we must have some means of measuring the temperature of a body, depending upon an *effect* of heat. Whatever that effect may be, it is obvious that, as the laws of nature are uniform, it will afford us a *reproducible* standard, by which we can estimate at any time and at any place an amount of heat, and compare that amount with another observed somewhere else; just as the French *mètre* is reproducible at any time, being (at least by its original definition) the ten-millionth part of a quadrant of the meridian.

Dilatation or Expansion.—Now, one of the most general and notable effects which heat produces on matter is to *expand* it. The length of a metallic bar varies with every change of temperature, and is ever the same at the same temperature. The fixing of the tire of a cart-wheel is a very good instance. No hammering could fit an iron hoop so tightly on the wood-work of the wheel as does the simple enlarging of the tire by heat, and its subsequent contraction by cold. It is thus possible to *slip* it on, and an enormous force is secured to bind the pieces together. In almost every kind of structure the expansion and contraction from changes of temperature require to be guarded against. In the huge iron tubes of the Britannia Bridge the mere change of the seasons would have produced sufficient changes of length to tear the piers asunder, had each end of a tube been fixed to masonry. Watches and clocks, when not compensated, go faster in cold weather, and slower in hot, an immediate consequence of the expansion or contraction of their balance-wheels and pendulums.

If a flask *full* of water or of alcohol be dipped into hot water or held over a lamp, the flask is heated first, and for a moment appears not quite full, but as heat reaches the liquid it expands in turn, and to a greater degree than the flask, so that a portion of the liquid runs over; a glass shell which just floats in a vessel of water, sinks to the bottom when the water is heated; and as water is gradually heated from below, the hotter water continually rises to the surface. Indeed, if this were not the case, it would be impossible to prevent explosions every time we attempted to boil water or any other fluid. If a bladder, partly filled with air, and tightly tied at the neck, be heated before a fire, the contained air will expand, and the bladder will be distended. As it cools it becomes flaccid again by degrees.

These and like instances are sufficient to show us that *in general* all bodies expand by heat. In order, then, to prepare a reproducible means of measuring temperature, all we have to do is to fix upon a substance (mercury is that most commonly used) by whose changes of volume it is to be measured, and a reproducible temperature, or rather two reproducible temperatures, at which to measure the volume. Those usually selected are—that at which water freezes, or ice melts, and that at which water boils. In both of those cases the water must be *pure*, as any addition of foreign matter generally changes the temperature at which freezing or boiling takes place. Another important circumstance is *the height of the*

barometer. The second reproducible temperature is therefore defined as that of water boiling in an open vessel when the barometer stands at 30 inches. In absolute strictness, this should also be said of the freezing-point, but the effect on the latter of a change of barometric pressure is practically insensible. The practical construction of a heat-measurer or *thermometer* on these principles, the various ways of graduating it, and how to convert the readings of one thermometer into those of another, are described in the article THERMOMETER. In the present article we suppose the Centigrade thermometer to be the one used.

If we make a number of thermometer tubes, fill them with different liquids, and graduate as in the Centigrade, we shall find that, though they all give 0° in freezing and 100° in boiling water, no two in general agree when placed in water between those states. *Hence the rate of expansion is not generally uniform for equal increments of temperature*. It has been found, however, by very delicate experiments, which cannot be more than alluded to here, that mercury expands *nearly* uniformly for equal increments of temperature. However, what we sought was not an *absolute* standard, but a *reproducible* one; and mercury, in addition to furnishing this, may be assumed also to give us approximately the ratios of different increments of temperature.

We must next look a little more closely into the nature of dilatation by heat. And first, of its *measure*. A metallic rod of length l at 0° increases at t° by a quantity which is proportional to t and to l . Hence, k being some numerical quantity, the expanded length $l' = l(1 + kt)$. Here k is called the coefficient of linear dilatation. For instance, a brass rod of length 1 foot at 0° becomes at t° $(1 + .0000187t)$ feet; and here k , or the coefficient of linear dilatation for one degree (Centigrade), is .0000187; or a brass rod has its length increased by about one fifty-three thousandth part for each degree of temperature.

If we consider a bar (of brass, for instance) whose length, breadth and depth are l , b , d —then, when heated, these increase proportionately. Hence,

$$\begin{aligned} l' &= l(1 + kt), \\ b' &= b(1 + kt), \\ d' &= d(1 + kt), \end{aligned}$$

and therefore the volume of, or space occupied by, the bar increases from V or lbd to V' or $l'b'd'$.

Hence $V' = V(1 + kt)^3$,

$= V(1 + 3kt)$ nearly, since k is *very small*.

Therefore we may write $V' = V(1 + Kt)$, where we shall have as before K , the coefficient of *cubical* dilatation for 1° of temperature. And, as $K = 3k$, we see that, for the same substance, the *coefficient of cubical dilatation is three times that of linear dilatation*.

In the following table these coefficients are increased a hundredfold, as it gives the proportional increase of length for a rise of temperature from 0° to 100° Centigrade. It must also be remarked that, while the *linear* dilatation of solids is given, it is the cubical dilatation of liquids and gases which is necessarily given. Moreover, as the latter are always measured in glass, which itself dilates, the results are only *apparent*; they are too small, and require correction for the cubical dilatation of glass. This, however, is comparatively very small, and a rough approximation to its value is usually sufficient.

Glass.....	.00086	Water.....	.0432
Iron.....	.00122	Alcohol.....	.116
Zinc.....	.00294	Air.....	.3665
Mercury.....	.01803	Hydrogen.....	.3668

There is one specially remarkable exception to the law that bodies expand by heat—viz., that of water under certain circumstances. From 0° (Centigrade),

at which it melts, it *contracts* as the temperature is raised, up to about 4° C., after which it begins to expand like other bodies. We cannot here enter into speculations as to the cause of this very singular phenomenon, but we will say a few words about its practical utility. Water, then, is *densest* or *heaviest* at 4° C. Hence, in cold weather, as the surface water of a lake cools to near 4° , it becomes heavier than the hotter water below, and sinks to the bottom. This goes on till the whole lake has the temperature 4° . As the surface cooling proceeds further, the water becomes *lighter*, and therefore remains on the surface till it is frozen. Did water not possess this property, a severe winter might freeze a lake *to the bottom*, and the heat of summer might be insufficient to remelt it all.

Specific Heat.—The thermometer indicates the *temperature* of a body, but gives us no direct information as to the *amount* of heat it contains. Yet this is measurable, for we may take as our UNIT the amount of heat required to raise a pound of water from 0° to 1° , which is of course a definite standard. As an instance of the question now raised—Is *more* heat (and if so, *how much more*) required to heat a pound of water from zero to 10° than to heat a pound of mercury between the same limits? We find by experiment that bodies differ extensively in the amount of heat (measured in the units before mentioned) required to produce equal changes of temperature in them.

It is a result of experiment (sufficiently accurate for all ordinary purposes) that, if equal weights of water at different temperatures be mixed, the temperature of the mixture will be the arithmetic mean of the original temperatures. From this it follows, with the same degree of approximation, that equal successive amounts of heat are required to raise the same mass of water through successive degrees of temperature. As an instance, suppose one pound of water at 50° to be mixed with two pounds at 20° , the resulting temperature of the mixture is 30° ; for the pound at 50° has lost 20 heat units, while each of the other two pounds has gained 10 such units, transferred of course from the hotter water. Generally, if m pounds of water at t degrees be mixed with M pounds at T degrees (the latter being the colder), and if θ be the temperature of the mixture—the number of units lost by the first is $m(t - \theta)$, since *one* is lost for *each* pound which cools by *one* degree; by and that gained by the second is $M(\theta - T)$, and these must be equal. Hence $m(t - \theta) = M(\theta - T)$; whence, at once,

$$\theta = \frac{mt + MT}{m + M}.$$

But if we mix water and mercury at different temperatures, the resulting temperature is found *not* to agree with the above law. Hence it appears that *to raise equal weights of different bodies through the same number of degrees of temperature requires different amounts of heat*. And we may then define the *specific heat* of a substance as the number of units of heat (as above defined) required to raise the temperature of *one* pound of it by *one* degree.

From the definition of a unit of heat it is at once seen that our numerical system is such that the specific heat of water is unity; and, in general, the specific heats of other bodies are less, and are therefore to be expressed as proper fractions. For example, if equal weights of water and mercury be mixed, the first at 0° , the second at 100° , the resulting temperature will not be 50° (as it would have been had both bodies been water), but $3^{\circ}.23$ nearly; in other words, the amount of heat which raises the temperature of one pound of water $3^{\circ}.23$ is that which would raise that of one pound of mercury $96^{\circ}.77$, or the

specific heat of mercury is one-thirtieth of that of water. The following may be given as instances of the great differences which experiment has shown to exist among bodies in respect of specific heat: Water, 1.000; turpentine, .426; sulphur, .203; iron, .114; mercury, .033.

It is mainly to the great specific heat of water that we are indebted for the comparatively small amount of it required to cool a hot body dropped into it; for its comparatively small loss of temperature when it is poured into a cold vessel; and for the enormous effects of the water of the ocean in modifying climate, as by the Gulf Stream.

It has been found generally that the specific heats of elementary solids are nearly *inversely* as their Atomic Weights. Hence their atoms require the same amount of heat to produce the same change in their temperature. Thus, for simple bodies, we have atomic weights of mercury, 100; its specific heat, .033; product, 3.3; atomic weight of iron, 28; its specific heat, .114; product, 3.2. A similar remark may be made, it appears, with reference to compound bodies of any one type; but, in general, the product of the specific heat and the atomic weight differs from one type to another.

Latent Heat, Fusion, Solution and Vaporization.

—We are now prepared to consider the somewhat complex effects produced by heat on the molecular constitution of bodies; and, conversely, the relation of solidity, fluidity, etc., to heat. All solid bodies (except carbon, which has been *softened* only) have been melted by exposure to a sufficiently high temperature. The laws of this fusion are:

(1) *Every body has a definite melting point, assignable on the thermometric scale, if the pressure to which it is subjected be the same.*

(2) *When a body is melting, it retains that fixed temperature, however much heat may be supplied, until the last particle is melted.* The last result is most remarkable. The heat supplied does not raise the temperature, but *produces the change of state*. Hence it seemed to disappear, as far as the thermometer is concerned, and was therefore called *latent heat*.

A pound of water at 79° C. added to a pound of water at 0° C. produces, of course, two pounds of water at $39^{\circ}.5$. But a pound of water at 78° C. added to a pound of *ice* at 0° C. produces two pounds of water at 0° . Heat, then, has *disappeared* in the production of a change from solidity to fluidity. And this we might expect from the conservation of ENERGY (*q. v.*), for energy in the shape of heat must be consumed in producing the potential energy of the molecular actions of the separate particles in the fluid. For every pound of ice melted, without change of temperature, 79 units of heat are thus converted into potential energy of molecular separation.

We give a few instances of latent heat of fusion: Water (as above), 79.0; zinc, 28.1; sulphur, 9.4; lead, 5.4; mercury, 2.8.

In law 1 it is mentioned that constancy of pressure is necessary. In fact, the freezing (or melting) point of water is *lowered* by increase of pressure, while those of sulphur or wax are *raised*; but these effects, though extremely remarkable, are *very small*. Most bodies contract on solidifying; but some, as water, cast-iron, certain alloys, etc., *expand*. Thus a severe frost, setting in after copious rain, splits rocks, etc., by the expansion of freezing water; and thus also we obtain in iron the most delicate and faithful copy of a mold, and in the fusible alloy a clear-cut copy of a type. The modern dynamical theory of heat (thermo-dynamics) enables us to see that a perpetual motion would be procurable if bodies which contract on solidifying had *not* their melting-point raised by pressure, and *vice versa*.

Analogous to the fusion of a solid is its *solution* in a liquid, or the mutual conversion into liquids of two solids which are intimately mixed in powder. Here, also, we should expect kinetic energy, in the shape of heat, to be used up in producing the potential energy of the liquid state; and, indeed, such is always the case. Such changes of arrangement destroy heat or produce cold; but this in many cases is not the effect observed, as there is generally heat developed by the *loss* of potential energy if there be *chemical* action between the two substances. Hence, in general, the observed effect will be due to the difference of the heat *generated* by chemical action and that *absorbed* in change of state.

If a quantity of pounded nitrate of ammonia (a very soluble salt) be placed in a vessel, an equal weight of water added and the whole stirred for a minute or two with a test-tube containing water, the heat required for the solution of the salt will be abstracted from all bodies in contact with the solution, and the water in the test-tube will be frozen. In this sense the arrangement is called a *freezing mixture*.

Of course the converse of this may be expected to hold, and latent heat to become sensible when a liquid becomes solid. As an example, when a supersaturated solution of sulphate of soda begins to deposit crystals of the salt with great rapidity the temperature rises very considerably; and it is the disengagement of latent heat that renders the freezing of a pond a slow process, even after the whole of the water has been reduced nearly to the freezing point.

Vaporization.—Almost all that has been said on the subject of fusion is true of vaporization, with the change of a word or two. Thus, however much heat we supply to a liquid, the temperature does not rise above the boiling point. Heat, then, becomes *latent* in the act of vaporization, or rather is *converted into* the potential energy involved in the change of state. It is found by experiment that 540 units of heat (each sufficient to heat a pound of water 1° C.) disappear in the conversion of a pound of water into steam. Hence a pound of steam at 100° C. is sufficient to raise 5.4 pounds of water from zero to the boiling point.

COMMUNICATION OF HEAT.—There are at least three distinct ways in which this occurs, and these we will take in order.

Conduction.—Why is it that, if one end of a poker and of a glass or wooden rod be put into a fire, we can keep hold of the other end of the latter much longer than we can of the former? The reason is that heat is more readily transmitted in the iron from particle to particle than it is in glass or wood. This is conduction. It is to be noticed, however, that in this experiment a great portion of the heat which passes along each rod is given off into the air by the surface. The mathematical theory of conduction has been most exquisitely investigated by Fourier, but on the supposition that the rate at which heat passes from a warmer to a colder portion of a body is proportional to the *difference* of temperature. As most of the experiments which have been made with the object of ascertaining the *conductivity* (not *conductibility*, the erroneous word too commonly in use) of different bodies have been made in this way, it is not surprising that our knowledge on this point is very meager indeed. We know that silver and copper conduct better than most other metals, and that the metals in general conduct better than other solids; but our further information is neither very extensive nor very definite. The first determinations of conductivity which are at all trustworthy are those of Forbes. His method was immensely superior to those of his predecessors. Before we give one or two numerical data,

we must explain what the numbers mean. The following definition is virtually that of Fourier:

The thermal conductivity of a substance is the number of units of heat which pass per unit of surface per unit of time, through a slab of unit thickness, whose sides are kept at temperatures differing by 1° C. Taking the unit of heat as above described, a foot as unit of length and a minute as unit of time, the conductivity of iron is about 0.8, while that of copper varies from 4 to little more than 2. (Very slight impurities affect to a great extent both the thermal and the electric conductivity of copper.) Contrasted with these we find that the conductivity of rocks is very small, ranging from 0.015 to 0.04.

In conjunction with their radiating power (see next section), the conductivity of bodies is most important as regards their suitability as articles of clothing for hot or cold climates, or as materials for building or furnishing dwelling-houses. We need but refer to the difference between linen and woolen clothing, or to the difference (in cold weather) of sensation between a carpet and a bare floor, in order to show how essential the greater or less conducting power of bodies is to our everyday comfort.

Radiation.—By this is understood the passage of heat, not from particle to particle of one body, but through air or vacuum, and even through solid bodies (in a manner and with a velocity quite different from those of conduction) from one body to another. There can be no doubt whatever as to radiant heat being *identical* with light, differing from red light, for instance, as red light differs from blue—*i.e.*, having longer waves than those corresponding to red light. This idea might easily have arisen during the contemplation of a body gradually heated. At first it remains dark, giving off only rays of heat; as its temperature increases it gives us, along with the heat, a low red light, which by the increase of the temperature, is gradually accompanied by yellow, blue, etc., rays, and the incandescent body (a lime-ball, for instance) finally gives off a light as white as that of the sun, and which therefore contains all the colors of sunlight in their usual proportions. In fact there is great reason to believe that the sun is merely a mass of incandescent matter, probably in the main gaseous, and that the radiations it emits, whether called heat or light, merely differ in *quality*, not in *kind*. Taking this view of the subject at the outset, it will be instructive to compare the properties of radiant heat with those of light throughout. It must be understood when we make this comparison that the term *heat* is improperly used in this connection. Radiant heat is not heat in the ordinary sense of the word. It is a form of energy, a *transformation* of the heat of a hot body, and can be transformed into heat again when it is absorbed, but on its passage it is not what we ordinarily understand by the word heat.

Light, then, *moves* (generally) *in straight lines*. This is easily verified in the case of heat by the use of the thermo-electric pile and its galvanometer. Placing the pile *out* of the line from a source of heat to an aperture in a screen, *no* effect is observed; but deflection of the needle at once occurs when the pile is placed in the line which light would have followed if substituted for the heat.

A concave mirror, which would bring rays of light proceeding from a given point to a focus at another given point, does the same with heat, the hot body being substituted for the luminous one, and the pile placed at the focus. Heat, then, is *reflected* according to the *same laws* as light. A burning lens gives a capital proof of the sun's heat and light being subject to the same laws of *refraction*. When the solar SPECTRUM (*q.v.*) is

formed by means of a prism of rock-salt (the reasons for the choice of this material will afterward appear), the thermo-electric pile proves the existence of heat in all the colored spaces, increasing, however, down to the red end of the spectrum, and attaining its maximum *beyond* the visible light, just as if radiant heat were (as it *must* be) light with longer waves.

Some bodies, as glass, water, etc., transmit, when in thin plates, most of the light which falls on them; others, as wood, metal, colored glass, etc., transmit none or little. A plate of rock-salt, half an inch thick, transmits 96 per cent. of the rays of heat which fall on it; while glass, even of a thickness of one-tenth of an inch, transmits very little. In this sense, rock-salt is said to be *diathermanous*, while glass is said to be *adiathermanous*, or only partially diathermanous. Most of the simple gases, such as oxygen, hydrogen, etc., and *mixtures* of these, such as air, oppose very little resistance to the passage of radiant heat; but the reverse is in general the case with compound gases. It has recently been asserted that water-vapor in particular is exceedingly *adiathermanous*. The question is one of very considerable difficulty, owing to the fact that it is almost impossible to experiment upon vapor alone. The presence of dust particles always produces deposition of *water*, which is a very good absorber of radiant heat.

But there are other remarkable phenomena of radiant heat which are easily observed, and which have their analogy in the case of light. (1) Unstained glass seems equally transparent to all kinds of light. Such is the case with rock-salt and heat. (2) Light which has passed through a blue glass (for instance) loses far less per cent. when it passes through a second plate of blue glass. Similarly heat loses (say) 75 per cent. in passing through *one* plate of crown-glass, and only 10 per cent. of the remainder (say) in passing through a second. (3) Blue light passes easily through a *blue* glass, which almost entirely arrests red light. So dark heat passes far less easily through glass than bright heat does. These analogies, mostly due to Melloni, are very remarkable.

Again, light can be *doubly refracted*, *plane polarized*, *circularly polarized*. All these properties have been found in radiant heat by Principal Forbes.

The beautiful investigations of Stokes, Balfour Stewart, and Kirchhoff have shown us that bodies which most easily *absorb* light of a particular color give off most freely, when heated, light of that color; and it is easily shown by experiment that those surfaces which absorb heat most readily also radiate it most readily. Thus, it was found by Leslie that when a tinned-iron cube full of boiling water had one side polished, another roughened, a third covered with lampblack, etc., the polished side radiated little heat, the roughened more, while the blackened side radiated a very great quantity indeed. And again, that if we have (say) three similar thermometers, and if the bulbs be (1) gilded, (2) covered with roughened metal, (3) smoked, and all be exposed to the same radiation of heat, their sensibility will be in the order 3, 2, 1. A practical illustration of this is seen in the fact that a *blackened* kettle is that in which water is most speedily made to boil, while a polished one keeps the water longest warm when removed from the fire. Again, if a willow-pattern plate be heated white-hot in the fire, and then examined in a dark room, the pattern will be reversed—a white pattern being seen on a dark ground. It is this law of equality of radiating and absorbing powers that mainly gives rise to the superior comfort of white clothing to black in winter as well as in summer; radiating less in winter, it absorbs less in summer.

Much has been argued about the separate existence of

cold, from such facts as these: A piece of ice held before the thermo-electric pile produces an opposite deflection of the galvanometer to that produced by a hot ball. If a freezing mixture be placed at one focus of a spheroidal mirror, and a thermometer with a blackened bulb at the conjugate focus, the latter will fall speedily, though very far off from the mixture. Now, the true explanation of such observations is to be found in what is called the "Theory of Exchanges," first enunciated by Prévost, and since greatly extended and carefully verified by Stewart, which is to this effect: "Every body is continually radiating heat in all directions, the amount radiated being greater as the temperature is higher." Thus the radiation from a body depends on *itself* alone, the amount absorbed depends on the radiation which reaches it. Hence the apparent radiation of cold in the experiments above mentioned is due to the fact of the pile or thermometer *radiating off more heat than it receives*, as its temperature is higher than that of the freezing mixture to which it is opposed. From this it is evident that any number of bodies left near each other tend gradually to assume a common temperature. By this theory of exchanges we explain the cold felt in sitting opposite an open window in a frosty day, even when there is no draught.

Convection.—A hot body cools faster in a current of air than in a still atmosphere of the same temperature, evidently because fresh supplies of the colder air are continually brought into contact with it. This carrying off of its heat by a stream of air is an example of convection. It is by convection mainly that heat is conveyed throughout liquids and gases. Thus, when a lamp is applied to the bottom of a vessel of water the heat does not diffuse itself in the water as it would (by conduction) in a mass of metal, but the expansion of the heated water at the bottom rendering it lighter, bulk for bulk, than the superincumbent fluid, causes it to rise to the surface; and thus, by convection, the heat is diffused through the mass. Conduction, properly so called, can scarcely be shown, though it really exist, in liquids or gases, on this account. The tremulous appearance of any object as seen by light which passes near a hot surface, as that of a boiler or a red-hot poker, is due to the convection of heat in the air, the warm current refracting light less than does the cold air.

Sources of light may, so far as we know, be ultimately reduced to two: chemical combination and mechanical energy, and indeed, in all probability, the former is only a variety of the immensely different forms in which the latter is manifested.

HEATH, the English form of a name given in most Teutonic dialects to the common ling or heather, but now applied to all species of *Erica*, an extensive genus of monopetalous plants, belonging to the order *Ericaceæ*. The heaths are evergreen shrubs, with small narrow leaves, in whorls usually set rather thickly on the shoots, the persistent flowers have four sepals, and a four-cleft campanulate or tubular corolla, in many species more or less ventricose or inflated; the dry capsule is four-celled, and opens, in the true *Erica*, in four segments, to the middle of which the partitions adhere, though in the ling the valves separate at the dissepiments. The plants are mostly of low growth, but several African kinds reach the size of large bushes, and a Spanish variety, *E. arborea*, occasionally attains almost the aspect and dimensions of a tree.

One of the best known and most interesting of the family is the common heath, heather, or ling, *Calluna vulgaris*. This shrub derives some economic importance from its forming the chief vegetation on many of those extensive wastes that occupy so large a portion of

the more sterile lands of northern and western Europe, the usually desolate appearance of which is enlivened in the latter part of summer by its abundant pink blossoms. When growing erect to the height of a yard or more, as it often does in sheltered places, its purple stems, close-leaved green shoots, and feathery spikes of bell-shaped flowers render it one of the handsomest of the heaths; but on the bleaker elevations and more arid slopes it frequently rises only a few inches above the ground. In all moorland countries the ling is applied to many rural purposes; the larger stems are made into brooms, the shorter tied up into bundles that serve as brushes, while the long trailing shoots are woven into baskets. Pared up with the peat about its roots it forms a good fuel, often the only one obtainable on the drier moors. The shielings of the Scotch Highlanders were formerly constructed of heath stems, cemented together with peat-mud, worked into a kind of mortar with dry grass or straw; hovels and sheds for temporary purposes are still sometimes built in a similar way, and roofed in with ling. Laid on the ground, with the flowers above, it forms a soft springy bed, the luxurious couch of the ancient Gael, still gladly resorted to at times by the hill shepherd or hardy deer-stalker. The young shoots were in former days employed as a substitute for hops in brewing, while their astringency rendered them valuable as a tanning material in Ireland and the Western Isles.

It was until recently supposed that no species of heath existed in America; but of late years isolated plants of ling have been found in various parts of New England, Nova Scotia, and Cape Breton, while it has been stated to occur in some abundance in several places in Newfoundland; probably in distant ages it may have had a wider range on the American continent.

The Cape heaths have long been favorite objects of horticulture. In the warmer parts of Britain several will bear exposure to the cold of ordinary winters in a sheltered border, but most need the protection of the conservatory. They are sometimes raised from seed, but are chiefly multiplied by cuttings "struck" in sand, and afterward transferred to pots filled with a mixture of black peat and sand; the peat should be dry and free from sourness. Much attention is requisite in watering heaths, as they seldom recover if once allowed to droop, while they will not bear much water about their roots; the heath-house should be light and well ventilated, the plants requiring sun, and soon perishing in a close or permanently damp atmosphere; in England little or no heat is needed in ordinary seasons. The European heaths succeed well in English gardens, only requiring a peaty soil and sunny situation to thrive as well as in their native localities: *E. carnea*, *mediterranea*, *eiliaris*, *vagans*, and the pretty cross-leaved heath of boggy moors, *E. tetralix*, are among those most worthy of cultivation. The beautiful large-flowered St. Dabeoc's heath, belonging to the closely allied genus *Menziesia*, is likewise often seen in gardens. The Scottish heather, although in itself an insignificant shrub, is associated largely with Scotch song and story.

HEATHCOAT, JOHN, the author of important inventions for facilitating the manufacture of Buckingham or French lace, was born at Duffield near Derby in 1783. During his apprenticeship to a framesmith near Loughborough, he made an improvement in the construction of the warp-loom, so as to produce mits of a lace-like appearance by means of it. He diligently prosecuted his experiments, and in 1808 constructed a machine capable of producing an exact imitation of real pillow-lace. Some time before perfecting his invention, which he patented in 1809, he removed to Loughborough, where he entered into partnership with Mr. Lacy, a Nottingham manufacturer; but in 1816 their factory

was attacked by the Luddites and the lace frames destroyed. The damages were assessed at £10,000; but as Heathcoat declined to expend the money in the county of Leicester he never received any part of it. Undaunted by his loss, he began at once to construct new and greatly improved machines in an unoccupied factory at Tiverton, Devonshire, propelling them by water-power and afterward by steam. His claim to the invention of the twisting and traversing lace machine was disputed, and a patent was taken out by a clever workman for a similar machine, which was decided at a trial in 1816 to be an infringement of Heathcoat's patent. He followed his great invention by others of much ability, as, for instance, contrivances for ornamenting net while in course of manufacture, and for making ribbons and platted and twisted net upon his machines, improved yarn spinning-frames, and methods for winding raw silk from cocoons. He also patented an improved process for extracting and purifying salt. An offer of £10,000 was made to him in 1833 for the use of his processes in dressing and finishing silk nets, but he allowed the highly profitable secret to remain undivulged. In 1832 he patented a steam plow, which stood foremost in public estimation until superseded by those of Fowler and others. He died in January, 1861.

HEATING. In temperate latitudes the climate is generally such as to necessitate in dwellings, during a great portion of the year, a temperature warmer than that out of doors, and, similarly, tropical plants growing in temperate climates require artificial heat in the house in which they are preserved. Thus heating is required for health and comfort: the object of the application of science is to obtain these with the greatest degree of economy. In its aspect as to health it may be assumed that no system of heating is advisable which does not provide for a constant renewal of the air in the locality warmed. In climates such as that of the Middle States of North America, the temperature of living rooms should be maintained at from 54° to 68° Fahr. in the daytime; the night temperature may be lower, but should not fall below 40°; and the humidity of the air as measured by the wet and dry bulb thermometers should show a difference of not less than 4° nor much exceeding 8° between the two thermometers, although with an ample supply of air a greater degree of dryness would probably not be found objectionable.

All heating apparatus depends upon the transference of heat from the fire to the various parts of the building which it is intended to warm, and this transfer may be effected by radiation, by conduction, or by convection. The ratio of the emission of heat increases with the temperature. It is thus easier to effect the warming of a given space by means of a highly-heated surface than by a surface emitting a lower temperature.

An open fire acts by radiation; it warms the air in a room by first, warming the walls, floor, ceiling and articles in the room, and these in their turn warm the air. Therefore in a room with an open fire the air of the room is, as a rule, less heated than the walls. In this case the warming of the air depends on the capacity of the surfaces to absorb or emit heat; except that the heat received by the walls may be divided into two parts, one part heating the air in contact with the wall, and the other passing through the wall to the outer surface, where it is finally dissipated and wasted. Fireplaces are sometimes constructed to assist the warming of the air of a room.

In a close stove, heated to a moderate temperature, the heat, as it passes from the fire, warms the surface of the materials which inclose and are in contact with the fire and with the heated gases. The materials next transfer the heat to the outer surface in contact with the

air; and the air is warmed by the agency of this outer surface. If heated to high temperatures a stove gives out radiant heat, which passes through the air to warm the objects on which the rays impinge.

With hot-water pipes, the heat from the water heats the inner surface of the pipe, and this surface transfers its heat to the outer surface through the material of the pipes. The rate at which the heat can pass from the inner to the outer surface, and be thus utilized instead of passing away straight into the chimney, depends on the heat evolved by the fire, on the extent of surfaces exposed to the heat and their capacity to absorb and emit heat, and on the quality of the material between the inner and the outer surface as a good or bad conductor of heat. This passage of heat through a body by conduction varies directly with the quality of material, and with the difference between the temperature of the inner surface exposed to the heat, and the outer surface exposed to a cooling influence, and inversely as the thickness between the surfaces. Other things being equal, copper is a better material than iron for conveying the heat from the fire to water or air; and coverings of brickwork, wood or woolen fabrics are better adapted than iron for retaining the heat. The property which appears more than any other to make materials good non-conductors of heat is their porosity to air, and the retention of the air in their pores.

The direct warming of the air may be effected by stoves with brick or iron flues, or by hot-water or steam pipes. The sizes of the heating surfaces for this object must be proportioned to the volume of air required to be warmed for ventilation, and the degree of heat to be maintained, the thickness of the material, and its capacity for absorbing and radiating heat and for transferring heat from one surface to the other. When a large volume of air is supplied and removed for ventilation, rapidity in transferring the heat from the fuel to the air is an important consideration. Brick stoves and flues are worse conductors of heat than iron stoves or flues, but the surface of a brick stove parts with the heat which reaches it somewhat more rapidly than do the surfaces of an iron flue. The slow conducting power of the material and the greater thickness of a brick stove prevent alternations which may take place in the fire from being felt so much as with iron stoves or flues; and therefore the brick stove warms the air more equably, without sudden variations; the air so warmed is free from objectionable elements; and where they can be conveniently applied, it is advisable to use brick stoves for warming air for ventilating purposes.

With an iron flue pipe from a stove, almost the whole heat which any fuel is capable of developing may be utilized by using a sufficiently long pipe, horizontal for the greater part of its length, to convey the products of combustion to the outer air. The heat given out by a stove pipe varies with the temperature from end to end, being of course greatest at the end next the stove, where the emission of heat is very rapid; and the amount of heat given out per square foot will vary at each point as the distance from the stove increases. The proportions also into which the heat divides itself between radiation and convection vary greatly with the temperature. Thus, with a stove pipe heated at the end nearest the stove to a dull red heat of 1230° Fahr., and of sufficient length to allow the heat to be diminished to 150° at the further end, it would be found that at the stove end of the flue pipe 92 per cent. of the total heat emitted by the pipe is given out by radiation to the walls, and only 8 per cent. to the air; but at the exit end the heat is nearly equally divided, the walls receiving 55 and the air 45 per cent. Taking the whole length of such a pipe, the walls would receive 74 per cent. and the

air 26 per cent. of the heat emitted. But with a flue pipe heated to lower temperatures, the air might receive half the heat or even more. When therefore the object is to heat the walls rather than the air, the temperature of the pipes should be high; and for this purpose stove pipes are more effective than hot-water or low-pressure steam pipes. At high temperatures there will be practically little difference of effect between horizontal and vertical flue pipes, because the heat given out is principally that due to radiation, which is independent of the form and position of the radiant. An adequate proportion of flue pipes to the form and size of the stove, involves a large surface for the flue pipe; with a careful observance of proportion, as much as $94\frac{1}{2}$ per cent. of the heat in the fuel has been utilized.

There are, however, several serious objections to iron stoves, especially for small rooms; a long flue pipe is unsightly, and on that account often inadmissible; iron stoves heat rapidly, and easily become red-hot, and the effect produced therefore is unequal. Carbonic oxide, too, has been found in air warmed by iron stoves very highly heated. It is alleged that highly-heated iron may take oxygen from the carbonic acid in the air in contact with its surface, and thus reduce the acid to carbonic oxide.

Whenever iron stoves are used for heating air, care should be taken to prevent the iron from attaining a high temperature, and with this object all iron stoves should have a lining of fire-brick, so as to prevent the fire from coming in direct contact with the iron; such an arrangement preserves greater regularity in the heating of the air. This object may be also attained by giving the stove a large surface in proportion to the fire by means of flanges or gills to carry off the heat as fast as it is generated. Iron coated with a surface of glazed enamel would enable the heat to pass rapidly from the fire to the surface, while the enamel surface would emit the heat more rapidly than the iron surface.

Hot-water pipes for warming air are free from many of the objections arising from the direct application of heat to iron, because the heat can be regulated with exactness.

A high temperature may be obtained from water without generating steam by heating it under pressure. In Perkin's high-pressure system, a continuous iron tube, about one inch diameter, is filled with water; about one-sixth of the length of the tube is coiled and placed in a furnace, and the remainder, forming the heating surface, is heated by the circulation of the water. At the highest level to which the tube is carried it is enlarged so as to allow of a space for expansion of the heated water equal to 5 per cent. of the contents of the small tube.

Pipes may be heated by either hot water or by steam. The higher the temperature, the greater is the comparative effect in warming air; therefore, with a small heating surface, steam pipes are more efficient than hot-water pipes, and steam at a high pressure more efficient than low-pressure steam. The efficient action of hot-water pipes depends upon the upward flow of the heated and expended water as it passes from the boiler, the passage being made as direct as possible, and so protected as to lose little heat between the boiler and the place where the heat is to be utilized. The return pipe, which brings back the water after it has been cooled down by the abstraction of heat in warming the air, should be passed into the bottom of the boiler as directly and in as uniform a line from the place where the heat has been used as possible. The velocity of flow in the pipes will depend upon the temperature at which the water leaves the boiler, the height to which the heated water has to rise, and the temperature at which it passes down

the return pipe back into the boiler. The efficiency of a hot water apparatus will be regulated by these conditions, by the size of the pipe, and by such other conditions as affect the flow of water in pipes. When the boiler or source of heat is very near the level of the pipes for heating the air, the average temperature which can be obtained in the pipes will be lower than when the vertical column is long. The heating surface must be regulated with reference to this difference of level. It may further be assumed that with small pipes, the temperature being constant, the velocity of flow in the pipe necessary to furnish a given amount of heat will vary in the ratio of the length of the pipe. When the water circulates through the pipes by virtue of the difference of temperature of the flow and return currents only, it is impossible to count upon a greater mean temperature of the pipes than from 160° to 180° , because above that temperature the water in the boiler begins to boil. To obtain a sufficient velocity of circulation for long distances, or with small differences of level, a forced circulation may be resorted to.

The amount of heating surface to be afforded with hot-water pipes depends mainly upon the volume of air to be admitted and removed, and the temperature desired to be maintained, but in any given building there are other circumstances to be taken into account, viz., the position, aspect, subsoil, temperature of locality, thickness of walls, size and form of windows, and other influences affecting the temperature of the incoming air, or causing loss of heat. An empirical rule has been laid down that in a dwelling house, one square foot of heating surface is required for every sixty-five cubic feet of space to be warmed, and in a greenhouse one square foot to every twenty-four cubic feet. This empirical rule does not take into account the sanitary considerations as to the renewal of air.

Steam-heated pipes present important advantages in some cases over hot-water pipes for heating purposes, because of the higher temperature to which the pipes can be raised, their consequent smaller size, and the facility of conveying the heat to a distance. Steam heating may be applied directly; and the waste steam from an engine is also applicable for heating.

The direct application of steam-heating on a large scale has been made at Lockport, N. Y. About 200 houses in the city are heated from a central supply through about three miles of piping, radiating from a boiler-house, which contains two boilers sixteen feet by five feet, and one boiler eight feet by eight feet. These boilers are fired during the winter to a pressure of thirty-five pounds to the inch, with a consumption of four tons of anthracite coal in twenty-four hours. The boiler pressure of thirty-five pounds in winter and twenty-five pounds in summer is maintained through a total length of three miles of piping up to the several points of consumption, where there is a cut-off under the control of the consumers. The first 600 feet of mains from the boilers are four inches in diameter. There are 1,400 feet of three-inch pipes, 1,500 feet of two and a half inch pipes, and 2,000 feet of two-inch pipes. The supply pipes from these mains to the houses are one and a half inches in diameter, and within each house three-fourth-inch pipes are used. In addition to the cut-off tap from the main under the control of the consumer, there is a pressure valve regulated to a five-pound pressure under the control of the company; and beyond this is an ingeniously constructed meter, which indicates, not only the total consumption in cubic feet of steam, but also the quantity of steam in each apartment. At each 100 feet of main an expansion valve, like an ordinary piston and socket, is inserted, allowing an expansion in each section of 100

feet of one and three-fourth inches for the heat at thirty-five-pound pressure. No condensation occurs in the mains. They are covered with a thin layer of asbestos paper next the iron, then a wrapping of Russian felt, and finally manilla paper, and the whole is encased in timber bored out three-quarters of an inch larger than the felt-covered pipes, and laid along the street like gas-pipes. The distribution of heat in the apartments is by means of radiators consisting of inch pipes, thirty inches long, placed vertically either in a circle or as a double row, and connected together at top and bottom, with an outlet pipe for the condensed water, which escapes at a temperature a little below boiling, and is sufficient for all the domestic purposes of the house, or it may be used as accessory heating power for horticultural and other purposes. The steam has also been applied at a distance of over half a mile from the boilers for motive power, and two steam engines of ten-horse and fourteen-horse power are worked from the boilers at a distance of half a mile with but a slightly increased consumption of fuel. The laid-on steam is also used for cooking purposes, for boiling, and even for baking. As in the case of gas supply, the steam supply company lay their pipes up to the houses, the consumer paying for all internal pipes, fittings, and radiators. In a moderately-sized eight-roomed house the expense of these amounted to \$150, and in larger houses with costlier fittings to \$500.

HEAVEN. See ESCHATOLOGY.

HEBBEL, FRIEDRICH, a German poet and dramatist, was born at Wesselburn, Schleswig-Holstein, March 18, 1813. He studied philosophy and history at Heidelberg and Munich. In 1841 he returned to Hamburg, where he published his first tragedy, *Judith*. In a journey which he made to Copenhagen, in 1842, he formed the acquaintance of Thorwaldsen and Oehlenschläger, and acquired the more substantial advantage of a traveling annuity from the king of Denmark. He accordingly visited Paris, after which he went to Italy, where he remained several years, staying principally at Rome, Pisa, and Palermo. Having in the spring of 1846 stopped at Vienna on his way home to Germany, he made the acquaintance of the actress Christine Engenhau, whom he married in May of the same year. His marriage led him to take up his permanent residence in Vienna, and probably deepened his interest in dramatic composition, which from that time chiefly occupied his attention. He died in 1863. His principal dramas are *Genoveva*, 1843; *Maria Magdalena*, 1844; *Julia*, 1851; *Agnes Bernauer*, 1855; and *Die Nibelungen*, 1862.

HEBE, in Greek mythology, is a personification of the blooming freshness and youth of nature. Originally she appears almost identical with the pure Greek Aphrodite (as distinguished from the Oriental goddess). Hebe is the daughter of Zeus and Hera, as Aphrodite of Zeus and Dione; but Dione and Hera are only two names for the same goddess. Like Aphrodite, Hebe is called the most beautiful of the gods. The meaning of the word Hebe tended to transform the goddess into a mere personification of the eternal youth that belongs to the gods, and this conception is frequently met with. Then she becomes identical with the Roman Juventas, who is simply an abstraction of an attribute of Jupiter Juventas, the god of increase and blessing and youth. Perhaps the most interesting point about Hebe is her connection with Heracles. When he was received among the gods and reconciled to Hera, Hebe was given him in marriage. The apotheosis of Heracles and his marriage with Hebe became a favorite subject with poets and painters.

HEBER, REGINALD (1783-1826), a distinguished prelate and hymn-writer, was born at Malpas in Cheshire, England, in 1783. He early showed remarkable

promise, and was entered in November, 1800, at Brasenose College, Oxford, where he proved a distinguished student, carrying off prizes for a Latin poem entitled *Carmen Seculare*, an English poem on *Palestine*, and a prose essay on *The Sense of Honor*. In November, 1804, he was elected a fellow of All Souls' College; and, after finishing his distinguished university career, he made a long tour on the continent. He was admitted to holy orders in 1807, and was then presented to the family living of Hodnet in Shropshire. In 1809 Heber married Amelia, daughter of Doctor Shipley, dean of St. Asaph. He was appointed Bampton lecturer for 1815, prebendary of St. Asaph in 1817, preacher at Lincoln's Inn in 1822, and bishop of Calcutta in January, 1823. Before sailing for India he received the degree of D.D. from the university of Oxford. In India Bishop Heber labored indefatigably, not only for the good of his own diocese, but for the spread of Christianity throughout the East. Animated by apostolic zeal, he undertook numerous tours in India, consecrating churches, founding schools, and discharging other Christian duties. Such devotion to his work in a trying climate told severely on his health. At Trichinopoly he was seized with an apoplectic fit when in his bath, and expired April 3, 1826.

Heber was a man of profound learning, refined literary taste and great practical energy. As a poet he has attained a high place. His *Palestine* is generally considered the best prize poem ever written at Oxford. Heber's fame rests mainly on his hymns, which, as literary compositions, rank among the best in the English language. Those beginning as follows may be instanced: "Lord of mercy and of might;" "Brightest and best of the sons of the morning;" "By cool Siloam's shady rill;" "God, that madest earth and heaven;" "The Lord of might from Sinai's brow;" "Holy, holy, holy, Lord God Almighty;" "From Greenland's icy mountains."

HEBERDEN, WILLIAM, a practical physician of some celebrity, was born in London in the year 1710. In 1724 he was sent to St. John's College, Cambridge, where he obtained a fellowship about 1730, became master of arts in 1732, and took his degree in physic in 1739. He remained at Cambridge about ten years longer as a practitioner of physic, and gave an annual course of lectures on *materia medica*. In 1746 he became a fellow of the Royal College of Physicians in London; and two years afterward established himself in London, where he was elected a fellow of the Royal Society in 1769. In 1778 he was made an honorary member of the Royal Society of Medicine at Paris. He died May 17, 1801.

HÉBERT, JACQUES RENÉ (1755-1794), a French revolutionist, surnamed from the newspaper he edited *Le Père Duchesne*, was born at Alençon in 1755. He went at an early age to Paris, where he lost more than one situation through malversation, and was in abject poverty when the occurrence of the French Revolution opened up to him a career in which he obtained considerable temporary success and permanent notoriety. Having shown great readiness and proficiency in a style of writing and of oratory which appealed to the worst feelings of the revolutionary mob, he soon acquired great influence in the clubs, and was chosen to oppose the constitutional paper *Le Père Duchesne* by editing a revolutionary paper of the same name. The scurrilous and extravagant language of the new print exactly coincided with the sentiments of the class to whom it was addressed, and it contributed not a little to several of the worst and most violent manifestations of the revolutionary spirit. It had a very beneficial influence on the fortunes of its editor, who after August 10, 1792, was one of the chief members of the revolutionary com-

mune, and on September 2d was appointed substitute to the *procureur syndic*. On May 24, 1793, an order was sent out for his arrest by the more moderate party of the commune on the ground that he was plotting their assassination, but on account of a formidable outbreak of the mob he was set at liberty, and when he appeared again at the commune he was presented with a civic crown. Having been appointed a member of the commission to examine Marie Antoinette, he with unsurpassed moral baseness foully accused her of a crime too scandalous to be mentioned. Along with several of his colleagues he invented the worship of the goddess "Reason," and subsequently he organized a party of ultra-revolutionists known as the Hébertists or *enragés*. The faction were, however, arrested by the committee of public safety, and on March 24, 1794, were led forth to execution. Hébert behaved with great cowardice at his trial.

HEBREW LANGUAGE AND LITERATURE.

The name *Hebrew* is a transcription of *'ebráyá*, the Aramaic equivalent of the original Old Testament word *'ibrí*, pl. *'ibrím*, which is the proper Gentile name of the people who also bore the collective name of Israel or Children of Israel. The name of Israel with its sacred associations in the patriarchal history is that by which the Old Testament writers prefer to designate their nation; and this circumstance, combined with the fact that the Sacred Text frequently employs the term Hebrews where foreigners are introduced as speaking or spoken to, has led to the conjecture that the name of Hebrews (men from the other side, *scil.* of the Euphrates) was originally given to the descendants of Abraham by their Canaanite neighbors, and continued to be the usual designation of the Israelites among foreigners. A closer view of the case does not confirm this conjecture. The name of Israel is often found in the Old Testament in the mouth of foreigners, and the whole *usus loquendi* is explained by the observation that the Gentile noun corresponding to the collective "Israel" is regularly "Hebrew" and not "Israelite," the latter word being rare and apparently of late formation. Nor has the word Hebrew been hitherto found in the early monuments of other Eastern nations; for the identification proposed by Chabas, which finds the Hebrews in the hieroglyphic Apurios is more than doubtful. On the other hand the name of Israel appears on the stone of Mesha king of Moab, and perhaps has been deciphered on Assyrian monuments.

The form *'ibrí* is, in the language of Semitic grammarians, a relative noun, presupposing the word *'Eber* as the name of the tribe, place, or common ancestor, from whom the Hebrews are designated. Accordingly we find Eber as a nation side by side with Assyria in the obscure poetical passage Num. xxiv. 24, and Eber as ancestor of the Hebrews in the genealogical lists of Gen. x., xi. Here we must apparently distinguish two records. According to Gen. xi. (and Gen. x. 24) Eber is the great-grandson of Shem through Arphaxad and ancestor of Terah through Peleg, Reu, Serug, and Nahor. These are not to be taken as the names of individual men. Several of them are designations of places or districts near the upper waters of the Euphrates and Tigris, and among other circumstances the place at the head of the series assigned to the district of Arrapachitis (Arphaxad), through which a migration from Ararat to the lands occupied by the Semites in historical times would first pass, suggests the probability that the genealogy is not even meant to exhibit a table of ethnological affinities, but rather presents a geographical sketch of the early movement of the Hebrews, who are personified under the name of Eber. If this is so we can hardly venture to assert (with some scholars) that

the author of the list (the Levitical Elohist) extended the name of Hebrews to all descendants of Terah.

When it is recognized that Eber in Genesis is not an actual personage but an ethnological or geographical abstraction, we are thrown back on etymological conjecture as to the origin of the name of Hebrews. 'Eber means the further bank of a river, from a root meaning *to cross*. Hence in Gen. xiv. 13 the Septuagint renders Abram the Hebrew by "the crosser." Grammatically more accurate, while resting on the same etymology, is the rendering of Aquila, "the man from the other side" of the Euphrates, which is the explanation of Jewish tradition and still generally adopted. It is, however, far from satisfactory, and almost of necessity depends on the theory that the name was fixed upon the Hebrew immigrants by the earlier inhabitants of Canaan.

By the Hebrew language we understand the ancient tongue of the Hebrews in Canaan—the language in which the Old Testament is composed, with the exception of the Aramaic passages. But we do not find that this language was called Hebrew by those who spoke it. It is the *lîp*, *i.e.*, speech of Canaan, Isa. xix. 18, or, as spoken in Southern Palestine. The later Jews call it the *holy tongue* in contrast to the *profane* Aramaic dialect (commonly though improperly enough called Syro-Chaldaic) which long before the time of Christ had superseded the old language as the vernacular of the Jews. This change had already taken place at the time when the expression "in Hebrew" first occurs (Prologue to Sirach); and both in the Apocrypha and in the New Testament the ambiguous term, naming the language after those who used it, often denotes the contemporary vernacular, not the obsolete idiom of the Old Testament. But the other sense was admissible, and naturally became the prevalent one among Christian writers who had little occasion to speak of anything but the Old Testament Hebrew. In modern usage it is incorrect to call the Jewish Aramaic Hebrew; though uneducated Jews apply the name even to the corrupt German and Spanish jargons which they are accustomed to write and print in Hebrew characters.

Hebrew is a language of the group which since Eichhorn has generally been known as Semitic, and of which Arabic and Ethiopic (Southern Semitic), the various dialects of Aramaic, and the language of the Assyrian and Babylonian cuneiform inscriptions are the chief representatives. From its geographical position as the language of Palestine between the Aramæans of the north and the Arabs of the south, Hebrew has been called Middle Semitic. Or Aramaic Assyrian and Hebrew may be grouped together as Northern Semitic in contrast to Arabic and Ethiopic. The affinities of the Semitic languages are so close that they may fairly be compared with a sub-group of the Indo-Germanic family—for example, with the Teutonic languages. The fundamental unity of the Semitic vocabulary is easily observed from the absence of compounds (except in proper names), and from the fact that almost all words are derived from their roots in definite patterns (*measures*) as regular as those of grammatical inflexion. The roots regularly consist of three consonants (seldom four or five), the accompanying vowels having no radical value, but shifting according to grammatical rules to express various embodiments of the root idea. The triliteral roots are substantially common to the whole Semitic group, subject to certain consonantal permutations, of which the most important are strikingly analogous to those laid down by Grimm for the Teutonic languages.

Before the rise of comparative philology it was a familiar opinion that Hebrew is the original speech of

mankind. Taken from the Jews, and as already expressed in the Palestinian Targum on Gen. xi. 1, this opinion drew its main support from etymologies and other data in the earlier chapters of Genesis, which, however, were as plausibly turned by Syriac writers in favor of their own tongue. Till quite recently many excellent scholars have claimed for Hebrew the greatest relative antiquity among Semitic tongues. But though Hebrew has by far the oldest literature, this does not prove that its structure comes nearest to the original Semitic language. And it is now generally recognized that in grammatical structure, the Arabic, shut up within its native deserts till the epoch of Islam, preserved much more of the original Semitic forms than either Hebrew or Aramaic. But while Arabic is in many respects the elder brother, it is not the parent of Hebrew or Aramaic. Each member of the group had an independent development from a stage prior to an existing language, though it would seem that Hebrew did not branch off from Aramaic so soon as from Arabic, while in its later stages it came under direct Aramaic influence.

The Hebrew spoken by the Israelites in Canaan was separated only by very minor differences (like those of provincial dialects) from the speech of neighboring tribes. We know this for the Moabite language from the stone of Mesha; and the indications furnished by proper names, as well as the acknowledged affinity of Israel with these tribes, make the same thing probable for Ammon and Edom. More remarkable is the fact that the Phœnicians and Canaanites, with whom the Israelites acknowledged no brotherhood, spoke a language which, at least as written, differs but little from Biblical Hebrew. This observation has been used in support of the very old idea that the Hebrews originally spoke Aramaic, and changed their language in Canaan. But an exacter study of the Phœnician inscriptions shows differences from Hebrew which suffice to constitute a distinct dialect, and combine with other indications to favor the view that the descendants of Abraham brought their Hebrew idiom with them from Haran. In this connection it is important to observe that the old Assyrian, which preceded Aramaic in regions with which the book of Genesis connects the origin of Abraham, is in many respects closely akin to Hebrew. As the origin of Hebrew is lost in the obscurity that hangs over the early movements of the Semitic tribes, so we know very little of the changes which the language underwent in Canaan. The existence of local differences of speech is proved by Judges xii. 6. In general it may be said that the Biblical text supplies inadequate data for studying the history of the language. Semitic writing, especially a purely consonantal text such as the Old Testament originally was, gives an imperfect picture of the very grammatical and phonetic details most likely to vary dialectically or in course of time. The later punctuation (including the notation of vowels), and even many things in the present consonantal text, represent the formal pronunciation of the synagogue as it took shape after Hebrew became a dead language—for even the Septuagint has often a more primitive pronunciation of proper names. This modern system being applied to all parts of the Old Testament alike, many archaisms were obliterated or disguised, and the earlier and later writings present in the received text a grammatical uniformity which is certainly not original.

The Semitic peoples possessed the art of writing and an alphabetical character from a date so remote as to be lost in the mists of antiquity. This character was formerly known as Phœnician, its invention being ascribed to that people. In reality it was the common

property of all Semitic nations between Assyria and Egypt—an alphabetic character in contact on the east and on the west with more complicated syllabic or hieroglyphic systems, from one or other of which it may possibly have been derived.

This ancient alphabet consists of twenty-two consonants. The vowels were supplied by the reader—which is not so difficult in Semitic languages, where vocalization constitutes no difference of root. This old character with its scanty indications of vowels continued to be used by the Hebrews throughout the flourishing period of their literature and for some time after the Exile, till at length they gradually adopted a newer form of letters (the square or, as the Talmud calls it, the Assyrian character) which was developed among the Aramæans and spread with the increase of Aramaic influence. Jewish tradition ascribes the introduction of the square character to Ezra; but the Samaritans, who did not receive the Pentateuch from the Jews till about 400 B.C., must have got it in the old letter, which they still retain in a corrupted form. The square letter probably did not prevail till a good deal later, the earliest Jewish inscription in which it appears being of the date 176 B.C., while the coins of Judea retain the old character still later. The transformation was complete before the time of Christ. The later introduction of vowel points and accents belongs to the history of the study of Hebrew as a dead language. The forms of the old Semitic alphabet are most suitable to be cut on stone, and indicate a special adaptation for monumental inscriptions (*cf.* the two tables of the Decalogue). Between the beginnings of such inscriptions and the general use of writing for literary purposes a considerable period might intervene. The earliest products of Hebrew authorship seem to have been lyrics and laws, which would circulate in the first instance from mouth to mouth without the use of written copies. We have notice of early written collections of lyrics prior to our present historical books—*Book of the Wars of Jehovah* (Num. xxi. 14) and the *Book of Jasher* (Josh. x. 13, 2 Sam. i. 18). We have no clue to the age of the former book, but the lines quoted from it are plainly of great antiquity. The *Book of Jasher* is not earlier than the time of Solomon; for a fragment from it referring to the building of the temple has been recovered from the Septuagint of 1 Kings viii. The earliest date of written law books is uncertain. It may fairly be made a question whether Moses left in writing any other laws than the commandments on the tables of stone. Even Ex. xxiv. 4 and xxxiv. 27 may in the original context have referred to the ten words alone. It is certain that ancient law was handed down by oral tradition and local custom to a much later date. The prophets frequently allude to the oral decisions of the priests as a source of law, and the practice of appealing to the local customs of certain towns is alluded to in 2 Sam. xx. 18. In like manner the story of the early fortunes of the nation down to the time of David often presents characteristics which point to oral tradition as its original source. Yet written history began comparatively early. A scribe was attached to the royal court from the reign of David downward; and the older parts of the books of Samuel, which must have been written not long after the time of that king (see DAVID), are framed in a masterly style, which shows that the art of composition in prose was already thoroughly understood. So, too, the best written and most brilliant part of the narrative of the Pentateuch—the combined history of the Jehovist and the non-Levitical Elohist—appears to be unquestionably earlier than the rise of prophetic literature in the eighth century B.C. In this narrative—itsself the product of more than one

writer—are included several collections of old laws, so that we have between the time of David and the age of Amos and Hosea a flourishing historical and legal literature, in which and in lyrical collections like the *Book of Jasher* were embodied many poems, legends and other remains, transmitted, whether orally or by writing, from a much earlier date. To the same period may be assigned the most interesting and graphic histories in the book of Kings, the splendid episode of Elijah, and other remains of Ephraïtic history; and to these must probably be added the main stock of the Song of Solomon, though this lyric drama has suffered much from interpolation, and presumably was not written down till a comparatively late date, and from imperfect recollection, so that its original shape is very much lost. It is mainly from the admirable prose narratives, to which nothing in later books can be compared, that we must judge of the first bloom of Hebrew literature under the ancient kingdoms of Judah and Ephraim, before the convulsions that accompanied the advance of Assyria and prior to the influence of written prophecy. That the Hebrews once possessed a poetry of high merit, drawn from the themes of ordinary life, appears, not only from the book of Canticles and such relics as the Song of the Well (Num. xxi. 17, 18), but from the names of popular airs preserved in the titles of the Psalms.

In this earliest period—the age of popular literature, as we may call it, modeled upon the songs and histories that circulated orally through the country—there is a remarkable preponderance of writings connected with the northern kingdom, and these include the narratives that are fullest of human interest and the poetry richest in color and imagination, such as the loves of Jacob and Rachel, the history of Joseph, the life of Elijah, the pictures of nature in the Canticles. The political and social superiority of Ephraim before the conflict with Assyria is reflected in the literature. A new epoch begins with the rise of written prophecy in the eighth century. By this time writing and literary knowledge were widely diffused. Amos, himself an excellent stylist, in whose book only perverse ingenuity can trace marks of rusticity, was a simple herdsman in the wilderness of Judah. Yet it appears that the origin of written prophecy was due less to the spread of education than to the rise of a new school of men whose whole method and aims were in conflict with the official prophetic societies, the unworthy successors of Samuel and Elijah.

In the terrible struggle with Nineveh, when the kingdom of Ephraim perished and Judea seemed lost beyond hope, the new prophecy established a spiritual and intellectual ascendancy which is stamped on the whole literature of the Assyrian and Chaldaean periods. In the book of Deuteronomy the ancient ordinances of Israel were rewritten in the prophetic spirit, and the reformation carried out by Josiah on the basis of this book is the decisive proof of the influence of the written word as the organ of prophetic ideas. The earliest written prophecy is nervous rhetoric of the old pregnant Hebrew style interspersed with bursts of song. Even before the Exile this style had undergone a change. Jeremiah was much occupied with the dark problems of providence and the meaning of the sufferings of the faithful in Israel, a topic which goes beyond the sphere of the earlier prophecy, but forms a chief theme of Isa. xl.–lxvi., and from a different point of view is taken up and discussed in the book of Job. The last named book is the highest utterance of another characteristic form of Hebrew literature, the Chokma, that is, wisdom or practical philosophy in parable, or epigrammatic or poetic form. The earliest distinct

trace of literary cultivation of this philosophy, which from its nature must at first have passed unwritten from mouth to mouth, is the collection of ancient proverbs by scholars in the service of Hezekiah.

The decadence of prophecy and the synchronous systematization of the ceremonial law on lines first drawn by Ezekiel mark the commencement of the third and last period of Hebrew literature. The freshest and best products of this period are the post-Exile psalms, the hymns of the second temple, which occupy a large part of the Psalter, and, though generally inferior to the older lyrics in the highest poetical qualities, are often full of the charm of genuine feeling and sweet utterance, and sometimes rise to a sublime energy of devotion and faith. With these psalms the graceful prose idyl of Ruth has a natural affinity. The other writings of the last age are on the whole much inferior. As the language decayed, the graces of the older prose style were lost. The memoirs of Ezra and Nehemiah, the colorless narrative of the Chronicles, and even the book of Esther, are singularly destitute of literary merit.

HEBREWS, EPISTLE TO THE. The New Testament writing usually known under this name, or less correctly as the Epistle of Paul the Apostle to the Hebrews, bears in the oldest MSS. no other title than the words, "To the Hebrews." This brief heading embraces the whole information as to the origin of the epistle, on which Christian tradition is unanimous. Everything else—the authorship, the address, the date—was unknown or disputed in the early church, and continues to form matter of dispute in the present day. But as far back as the latter part of the second century the designation of the epistle "to the Hebrews" was acknowledged alike in Alexandria, where it was ascribed to Paul, and in Carthage, where it passed by the name of Barnabas, and no indication exists that it ever circulated under another title. At the same time we must not suppose, as has sometimes been done, that the author prefixed these words to his original manuscript. The title says no more than that the readers addressed were Christians of Jewish extraction, and this would be no sufficient address for an epistolary writing directed to a definite circle of readers, a local church or group of churches to whose history repeated reference is made, and to which the author had personal relations. The original address, which according to custom must have stood on the outside of the folded letter, was probably never copied, and the early and universal prevalence of the present title, which tells no more than can be readily gathered from the epistle itself, seems to indicate that when the book first passed from local into general circulation its history had already been forgotten. The early Roman Church, where the epistle was known about the end of the first century, and where, indeed, the first traces of the use of it occur, had nothing to contribute to the question of authorship and origin except the negative opinion that the book is not by Paul. Caius and the Muratorian fragment reckon but thirteen epistles of Paul; Hippolytus (like his master Irenæus of Lyons) knew our book, and declared that it was not Pauline. These facts can hardly be explained by supposing that at Rome during the second century the book had dropped out of notice, and its history had been forgotten. Clement, Hermas, Hippolytus form a tolerably continuous chain, and the central Church of Rome was in constant connection with provincial churches where, as we shall presently see, the epistle had currency and reputation. Under these circumstances an original trustworthy tradition could hardly have been lost, and it must appear highly questionable whether the author and address of the book were known at Rome even in the

time of Clement. The earliest positive traditions of authorship to which we can point belong to Africa and Egypt, where, as we have already seen, divergent views were current by the end of the second century. The African tradition preserved by Tertullian, but certainly not invented by him, ascribes the epistle to Barnabas. Direct apostolic authority is not, therefore, claimed for it; but it has the weight due to one who "learned from and taught with the apostles," and we are told that it had more currency among the churches than "that apocryphal shepherd of the adulterers" (the Shepherd of Hermas). This tradition of the African Church holds a singularly isolated position. Later writers appear to know it only from Tertullian, and it soon became obsolete, to be revived for a moment after the Reformation by the Scottish theologian, Cameron, and then again in our own century by the German critics, among whom at present it is a favorite view. Very different is the history of the Egyptian tradition, which can be traced back as far as a teacher of the Alexandrian Clement, presumably Pantænus. This "blessed presbyter," as Clement calls him, sought to explain why Paul did not name himself as usual at the head of the epistle, and found the reason in the modesty of the author, who, in addressing the Hebrews, was going beyond his commission as apostle to the Gentiles. Clement himself takes it for granted that an epistle to the Hebrews must have been written in Hebrew, and supposes that Luke translated it for the Greeks. Thus far there is no sign that the Pauline authorship was ever questioned in Alexandria. Origen rests on the same tradition, which he refers to "the ancient men." But he knows that the tradition is not common to all churches. He feels that the language is un-Pauline, though the admirable thoughts are not second to those of the unquestioned apostolic writings. And thus he is led to the view that the ideas were orally set forth by Paul, but that the language, arrangement, and some features of the exposition are the work of a disciple. According to some this disciple was Clement of Rome; others named Luke; but the truth, says Origen, is known to God alone. From the time of Origen the opinion that Paul wrote the epistle became more and more prevalent in the East. In the West this view was still far from established in the fourth century. But it gained ground steadily; even those who, like Jerome and Augustine, knew the variations of tradition, were unwilling to press an opposite view; and in the fifth century the Pauline authorship was accepted at Rome, and practically throughout Christendom, not to be again disputed till the revival of letters and the rise of a more critical spirit.

As criticism strengthened its arguments, theologians began to learn that the denial of tradition involves no danger to faith, and at the present moment scarcely any sound scholar will be found to accept Paul as the direct author of the epistle, though such a modified view as was suggested by Origen still claims adherents among the lovers of compromise with tradition.

The arguments against the Alexandrian tradition are in fact conclusive. It is probably unfair to hamper that tradition with Clement's notion that the book is a translation from the Hebrew. But just as little can the Greek be from Paul's pen. The un-Pauline character of the style, alike in the words used and in the structure of the sentences, strikes every scholar as it struck Origen and Erasmus. The type of thought is quite unique. The theological ideas are cast in a different mold; and the leading conception of the high priesthood of Christ, which is no mere occasional thought, but a central point in the author's conception of Christianity, finds its nearest analogy not in the Pauline epistles, but in John. The Old Testament is cited after the Alexandrian trans-

lation more exactly and exclusively than is the custom of Paul, and that even where the Hebrew original is divergent. Nor is this an accidental circumstance. There is every appearance that the author was a Hellenist whose learning did not embrace a knowledge of the Hebrew text, and who derived his metaphysic and allegorical method from the Alexandrian rather than the Palestinian schools.

But all investigation regarding the person of the author only permits us to say that he was a man of the first intellectual mark and of Alexandrian culture, whose home and work lay mainly among Jewish Christians, but who was at the same time associated with the Pauline circle. Of the names offered to us in other New Testament writings, Barnabas and Apollos seem the most likely, and Barnabas will claim the preference if we are entitled to give any weight to tradition. Either name would go well with the Alexandrian address. Apollos was an Alexandrine Jew. Barnabas was of Cyprus, always closely connected with Egypt; and the tradition which connects his relative and associate Mark with the Church of Alexandria is as old as the second century.

HEBRIDES, THE, or WESTERN ISLES OF SCOTLAND, is a name sometimes applied collectively to all the islands on the west coast of Scotland, but seldom including Bute, Arran, and the other islands situated in the Firth of Clyde. The group is usually divided into the Outer Hebrides, or Long Island, and the Inner Hebrides. The former division embraces the Lewis, Harris, North and South Uist, Benbecula, Barra, and a number of small islands, the whole length of this group, from Barra-Head to the Butt of Lewis, being about 130 miles. The Inner Hebrides include Islay, Skye, Mull, Jura, Coll, Colonsay, Rum, Eigg, Tiree, Lismore, and Ulva. The number of inhabited isles is over 100, and the population is nearly 100,000. The outer range consists almost exclusively of gneiss rocks, with poor soil and large proportions of peat and moor. The inner range is composed chiefly of trap and slate. The scenery of the islands may be generally described as partaking of the wild and sublime. Large masses of mountains of all forms tower up in the interior; and the coasts, indented by arms of the sea, are rugged and varied in outline. Spots of great beauty—green pastoral glens, sheltered bays and lakes—are interspersed with the wildest scenes. The climate, though mild, is humid and unsuitable for corn crops. Only a very small portion of the surface is arable; the greater part being mountains, and the valleys intersecting them narrow and frequently covered with peat moss. Much of the land has, however, been converted into sheep walks, and the moors and desolate tracks are often let at high rents to sportsmen. The development of the prosperity of the islands has been greatly aided by the construction of excellent roads, and by the establishment of various lines of steamers in connection with Glasgow, thus rendering the fine and in some respects unique scenery fully and easily accessible to tourists. One of the principal sources of wealth is that of the fisheries, Stornoway in the island of Lewis being the headquarters of that industry on the western coast.

The decline and ruin of the Hebridean peasantry were brought about by the rapacity of the landlords. A new system of management and high rents was imposed, in consequence of which numbers of the tacksmen, or large tenants, emigrated to America. The exodus continued for many years. Sheep-farming on a large scale was next introduced, and the crofters were thrust into villages or barren corners of the land. The consequence was that, despite the numbers who entered the army or emigrated to Canada, the standard of

civilization sank lower, and the population multiplied in the islands. The people came to subsist almost entirely on potatoes and herrings; and in 1846, when the potato blight commenced its ravages, a scene of nearly universal destitution ensued—embracing, over the islands generally, seventy per cent. of the population. Temporary relief was administered in the shape of employment on roads and other works; and an emigration fund being raised, from 4,000 to 5,000 of the people in the most crowded districts were removed to Australia.

The principal books on the Hebrides are Martin's *Description of the Western Islands of Scotland*, 1703; Pennant's *Tour in Scotland and Voyage to the Hebrides*, 1774; Sir Joseph Banks' *Contributions to Pennant's Tour*; Boswell's *Tour to the Hebrides with Samuel Johnson, LL.D.*; Macculloch's *Geological Account of the Hebrides*, 1816; Hugh Miller's *Cruise of the Betsy*; W. A. Smith's *Lewisiana, or Life in the Outer Hebrides*, 1874.

HEBRON, the most southern of the three cities of refuge west of Jordan, built "seven years before Zoan (Tanis) in Egypt." Tanis, according to Brugsch, was standing at least 2,400 years B.C. Hebron was originally called Mamre and Kirjath Arba, after Arba, one of the Anakim. It is frequently mentioned in the Old Testament. The present town incloses the *Haram* or sanctuary built over the supposed site of Machpelah; but if this site be (as seems probable) genuine, the ancient Hebron must have faced the cave, as is remarked by many ancient writers. The name Machpelah signifies "place of division," and the cave was therefore called as early as the sixth century *Spelunca Duplex*. In the twelfth century an iron door (still visible) is mentioned as leading from the *Haram* wall to the cavern. In 1167 A.D. Hebron became the see of a Latin bishop, and it was taken in 1187 by Saladin. In 1834 it joined the rebellion against Ibrahim Pasha, who took the town and pillaged it. Modern Hebron rises on the east slope of a shallow valley—a long narrow town of stone houses, the flat roofs having small stone domes. The main quarter is about 700 yards long, and two smaller groups of houses exist north and south of this. The hill behind is terraced, and luxuriant vineyards surround the place, which is well watered on the north by three principal springs, including the Well Sirah. Three conspicuous minarets rise, two from the *Haram*, the other in the north quarter. The population includes 17,000 Moslems and 600 Jews.

HECATÆUS, son of Hegesander, was sprung from an ancient and noble family of Miletus. His life seems to fall between the years 550 and 475 B.C. His earlier years were spent in traveling. He lived some time in Egypt; he was well acquainted with the resources and power of the Persian empire, and the extant fragments of his writings seem to imply personal acquaintance with Libya, Spain, and Italy, as well as with the countries bordering on the Ægean and Euxine seas. After middle life he seems to have settled in Miletus, where he occupied a position of great honor, and to have devoted his time to composition of geographical and historical works.

HECATÆUS, of Abdera, sometimes confounded with Hecataeus of Miletus, was a Greek historian and philosopher of the fourth century B.C. He was a disciple of Pyrrho and a contemporary of Alexander the Great and Ptolemy Sotor.

HECATE, a Greek goddess who is never mentioned in Homer, but is of great importance in other parts of the literature as well as in religious observance. The name Hecatos, the masculine corresponding form, is a frequent epithet of Apollo; and though the word Hecate is never

used exactly as an epithet of Artemis, yet this suggests a close relationship between the two goddesses, which an examination of their functions fully confirms. Their character and attributes stamp both as moon-goddesses. In fact, though often distinguished from Artemis, yet at other times Hecate is identified with her. The worship of Hecate seems to have flourished especially among the wilder tribes of Greek nationality, in Samothrace, Thessaly, and elsewhere; she has, however, been received into the Pantheon of the more civilized Greek races, probably on account of her close resemblance to Artemis; and this is doubtless the meaning of Hesiod's statement that she alone of all the Titanic powers was left undisturbed in her honors by Zeus. The parentage of Hecate is variously given. Hesiod names her father Perses (a word connected with Perseus, Persephone, etc., all of which denote powers of light) and her mother Asteria, the starry sky of night. Zeus and Demeter, Zeus and Hera, etc., are also named as her parents.

HECKMONDWYKE, a town of England, in the West Riding of Yorkshire, on the Huddersfield and Bradford Railway, two miles northwest of Dewsbury and ten miles southwest of Leeds. Population (1890), 10,000.

HECLA. See ICELAND.

HECTOR, son of Priam and Hecuba, the champion of the Trojans and the mainstay of their city. Like Paris and other Trojans, he had an Oriental name, Darius, as well as a Greek one, an interesting fact on which many fanciful theories have been founded. He was married to Andromache, daughter of Eetion, king in the Cilician Thebe. By Homer his character is drawn in most favorable colors as a good son, a loving husband and father, and a trusty friend, — religious without superstition, tender-hearted yet courageous. He is an especial favorite of Apollo, and later poets even describe him as son of that god. When Achilles, enraged with Agamemnon, deserted the Greeks, Hector drove them back to their ships, which he almost succeeded in burning. Patroclus, the friend of Achilles, who came to the help of the Greeks, was slain by Hector with the help of Apollo. Then Achilles, to revenge his friend's death, returned to the war, slew Hector, dragged his body behind his chariot to the camp, and afterward dragged it around the tomb of Patroclus. Priam, guarded by Hermes, went to Achilles and prevailed on him to give back the dead body, which was buried with great honor.

HECUBA (the Latin form of the Greek *Hekabe*), wife of Priam, is in Homer daughter of the Phrygian king Dymas, who dwelt on the bank of the Sangarius; but according to Euripides, Virgil, etc., her father was named Cisseus. According to Homer she was mother of nineteen of Priam's fifty sons. When Troy was captured and Priam slain, she was made prisoner by the Greeks. Her fate is told in various ways, most of which connect her with the promontory Cynossema, on the Thracian shore of the Hellespont.

HEDA, WILLEM CLAASZ, Dutch painter, born at Haarlem it is said in 1594, and still living there in 1668, was one of the earliest Dutchmen who devoted himself exclusively to the painting of still life.

HEDGEHOG (*Erinaceus europæus*, Linn.), is the best known, and from an anatomical point of view perhaps the most characteristic, of the *Insectivora*. The genus is remarkable for its dentition, its armature of spines, and its short tail, while the ordinary species is characterized by not having the spines longer than the head or the ears more than half that length. The upper jaw is longer than the lower one, and the whole snout, which is long and flexible, has somewhat the appearance

of that of the hog; the nostrils are narrow; and the claws are long but weak. The animal is about ten inches long, its eyes are small, and the integument of the ventral surface is covered with hairs of the ordinary character.

The most remarkable point in its external appearance is the possession of spines, and the power possessed by it of rolling itself up into a ball, from which these spines stand out in every direction. The spines, which are modified hairs, are sharp, hard, and elastic, and form so efficient a defense that there are but few animals that are able, and even they rarely, to effect a successful attack on this curious creature. The moment it is touched, or even hears the sound of so slight a menace as the report of a gun, it rolls itself up by the action of the powerful muscles which lie just beneath the skin, while the same contraction effects the erection of the spines.

During the cold of winter it passes into a state of complete hibernation, and its temperature falls very considerably; having provided itself with a nest of dry leaves, it is well protected from the influences of the rain, and, rolling itself up, it remains undisturbed till distinctly warmer weather returns. In July or August the female brings forth four to eight young, or, according to others (Bell), two to four at a somewhat earlier period; at birth the spines, which in the adult are black in the middle, are white and soft, but soon harden, though they do not attain their full size until the succeeding spring. It is commonly found in woods and gardens, and extends over nearly the whole of Europe; it has been found at 6,000 to 8,000 feet above the level of the sea. It can be tamed and is useful, as it has a voracious appetite for beetles. The English gypsies eat it, and claim that its flesh is superior to that of the rabbit.

HEDGE-SPARROW. See SPARROW.

HEEM, JAN DAIDSZ VAN (or JOHANNES DE), was born according to Houbraken and Sandrart in 1604; according to Descamps in 1600, at Utrecht, and died at Antwerp in 1683 or 1684. Thoré has said of Heda, but it is only true of De Heem, that "he glorified insects, butterflies, and all the minute beings that swarm in vegetation, and made the moth drink in cups of chased gold." He was, if not the first, certainly the greatest painter of still life in Holland; no artist of his class combined more successfully perfect reality of form and color with brilliancy and harmony of tints.

CORNELIUS DE HEEM, the son of Johannes, was in practice as a flower painter at Utrecht in 1658, and was still active in his profession in 1671 at the Hague. His pictures are not equal to those of his sire, but they are all well authenticated, and most of them in the galleries of the Hague, Dresden, Cassel, Vienna, and Berlin.

DAVID DE HEEM, another member of the family, entered the guild of Utrecht in 1668, and that of Antwerp in 1693. The best piece assigned to him is a table with a lobster, fruit, and glasses, in the gallery of Amsterdam; others bear his signature in the museums of Florence, St. Petersburg and Brunswick.

HEEMSKERK, JOHAN VAN, Dutch poet, was born at Amsterdam in 1597, and died there in 1656.

HEEMSKERK, MARTIN JACOBSZ, sometimes called Van Veen, was born in Holland in 1498, and apprenticed to Cornelisz Willemsz, a painter at Haarlem. He was selected to coöperate with Antonio da San Gallo, Battista Franco, and Francesco Salviati to decorate the triumphal arches erected at Rome in April, 1536, in honor of Charles V. Vasari, who saw the battle-pieces which Heemskerk then produced, says they were well composed and boldly executed. On his return to the Netherlands he settled at Haarlem, where

he soon (1540) became president of his guild, married twice, and secured a large and lucrative practice. In 1572 he left Haarlem for Amsterdam, and died in 1574.

HEEREN, ARNOLD HERMANN LUDWIG, an eminent German historian, was born October 25, 1760, at Arbergen near Bremen. He studied philosophy, theology, and history at Göttingen, and thereafter traveled in Italy, France, and the Netherlands. In 1787 he was appointed one of the professors of philosophy at Göttingen, and he afterward was chosen aulic councilor, privy councilor, etc.; received in short those rewards which are the lot of successful German scholars. He died March 7, 1842.

HEGEL, GEORG WILHELM FRIEDRICH, was born at Stuttgart on August 27, 1770. In the autumn of 1788 he entered at Tübingen as a student of theology; but his sermons were a failure; and, instead of seeking after academical distinction, he found more congenial reading in the classics, on the advantages of studying which his first essay was written. After two years he took the customary degree of Ph.D., and in the autumn of 1793 received his theological certificate.

His university career, unlike that of Schelling, who, five years younger, came to Tübingen in 1790, was not brilliant. Hegel was quietly making himself at home in the Greek and Roman world, and gathering stores of miscellaneous information. But he gained most from intellectual intercourse with his contemporaries. Several of these are mentioned, but the two best known to fame were Hölderlin and Schelling. The former, who was of the same age as Hegel, left for Jena about the time that Schelling arrived. With him Hegel learned to feel for the old Greeks a love which grew stronger as the semi-Kantianized theology of his teachers more failed to interest him. With Schelling like sympathies bound him. They both protested against the political and ecclesiastical inertia of their native state, and adopted with fervor the revolutionary doctrines of freedom and reason.

Like many a German student, Hegel was glad of a tutorship, in 1793, when his university course ended. For three years he taught the children of a M. Steiger of Tschugg. Tschugg was the summer residence of the family, near Erlach on the lake of Biel; in winter they lived in Bern. Little happened in these years. Hegel had a few acquaintances in Bern; but, on the whole, intellectually he lived in isolation. But the main factor in Hegel's mental growth came from his study of Christianity. Under the impulse given by Lessing and Kant he turned to the original records of Christianity, and attempted to construe for himself the real significance of Christ. He wrote a life of Jesus, in which Jesus was simply the son of Joseph and Mary. He did not stop to criticise as a philologist, and simply ignored the miraculous. He asked for the secret contained in the conduct and sayings of this man which made him the hope of the human race. To Hegel, Jesus appeared as revealing the unity with God in which the Greeks in their best days unwittingly rejoiced, and as lifting the eyes of the Jews from a lawgiver who metes out punishment on the transgressor, to the destiny which in the Greek conception falls on the just no less than on the unjust.

During these years of arduous wrestling with the problems of religion, Hegel kept up a slack correspondence with Schelling and Hölderlin. Schelling was already on the way to fame. He was trying (to quote his own words) to find the premises to the results of Kant. Meanwhile he kept Hegel abreast with German speculation. After lamenting his want of books, Hegel concludes a letter of 1795 with the words, "Let reason and

freedom remain our watchword, and our point of union the church invisible."

Toward the close of his engagement at Bern, Hegel had received hopes from Schelling of a post at Jena. Tired of isolation, he was anxious to get away from Bern. Fortunately his friend Hölderlin, who was now tutor in Frankfort, secured a similar situation there for Hegel in the family of a Herr Gogol, a merchant. Hegel entered upon his new post in January, 1797.

It may have been the political position of Frankfort that made Hegel about this time turn to questions of economics and government. He had studied Gibbon, Hume, and Montesquieu in Switzerland.

The best evidence of Hegel's attention to contemporary politics is two unpublished essays—one of them written in 1798, "On the Internal Condition of Würtemberg in Recent Times, particularly on the Defects in the Magistracy," the other a criticism on the constitution of Germany, written, it is probable, not long after the peace of Lunéville (1801). The main feature in the pamphlet is the recognition that a spirit of reform is abroad. If Würtemberg suffered from a bureaucracy tempered by despotism, the Fatherland in general suffered no less. "Germany," so begins the second of these unpublished papers, "is no longer a state." Referring the collapse of the empire to the retention of feudal forms and to the action of religious animosities, Hegel looked forward to reorganization by a central power (Austria) wielding the imperial army, and by a representative body elected by the geographical districts of the empire. But such an issue, he saw well, could only be the outcome of violence—of "blood and iron."

At Frankfort, the philosophic ideas of Hegel first assumed the proper philosophic form. In a MS. of one hundred and two quarto sheets, of which the first three and the seventh are wanting, there is preserved the original sketch of the Hegelian system, so far at least as the logic and metaphysics and part of the philosophy of nature are concerned. The third part of the system—the ethical theory—seems to have been composed afterward; it is contained in its first draught in another MS., of thirty sheets.

Hegel arrived at Jena in January, 1801. An end had already come to the brilliant epoch at Jena, when the romantic poets, Tieck, Novalis, and the Schlegels made it the headquarters of their fantastic mysticism, and Fichte turned the results of Kant into the banner of revolutionary ideas. Schelling was the main philosophical lion of the time; and in some quarters Hegel was spoken of as a new champion summoned from Swabia by Schelling to help him in his struggle with the more prosaic continuators of Kant. Hegel's first performance seemed to justify the rumor. It was an essay on the difference between the philosophic system of Fichte and Schelling, tending in the main to support the latter. Still more striking was the agreement shown in the *Critical Journal of Philosophy*, which Schelling and Hegel wrote conjointly during the year 1802-3.

Hegel's earliest lectures, in the winter of 1801-2, on logic and metaphysics were attended by about eleven students. At a later period, in 1804, we find him with a class of about thirty, lecturing on his whole system; but his average attendance was rather less. Besides philosophy, he once at least lectured on mathematics.

On October 14, 1806, Napoleon was at Jena. But Hegel, like Goethe, felt no patriotic shudder at the victory, and in Prussia he saw only a corrupt and conceited bureaucracy. The scholar's wish was to see the clouds of war pass away, and leave thinkers to their peaceful work. Early in 1807 he went to Bamberg, and stayed for about eighteen months. Of his editorial work there is little to tell.

From December, 1808, to August, 1816, Hegel was schoolmaster. Bavaria, at this time under the direction of Montgelas, was modernizing her institutions. The school system was reorganized by new regulations, which, *inter alia*, prescribed a training in philosophy as part of the gymnasial course. To this regulation (with which Hegel, however, was not agreed) we owe a series of lessons in the outlines of philosophy—ethical, logical, and psychological—which Hegel drew up with great care and many revisions. They were published in 1840 by Rosenkranz from Hegel's papers.

As a teacher and master Hegel seems to have been fairly successful. He inspired confidence in his pupils and maintained discipline without pedantic interference in their associations and sports.

On September 16, 1811, in the summer vacation, Hegel married Marie von Tucher. Two sons were born to them; the eldest, Karl, born June 7, 1813, has since become eminent as a historian. The younger was named Immanuel, born September 24, 1816. The year after his marriage appeared the first two volumes of his *Wissenschaft der Logik*, and the work was completed by a third in 1816. This work, in which his system was for the first time presented in what, if we except a few minor alterations, was its ultimate shape, found some audience in the world, and from here and there came voices of encouragement. Toward the close of his eighth session three professorships were almost simultaneously put within his reach,—at Erlangen, Berlin, and Heidelberg.

In 1817 he brought out the *Encyclopædia of the Philosophical Sciences*, in outline, for use at his lectures. In its first form it was a small treatise of about 300 octavo pages; but in the second of 1827, and the third of 1830, it rapidly grew to twice the original bulk. It is the only exposition of the Hegelian system as a whole which we have direct from Hegel's own hand. Besides this work he wrote two reviews for the Heidelberg *Jahrbücher*—the first on Jacobi, the other a political pamphlet which called forth violent criticism. It was entitled a *Criticism on the Transactions of the Estates of Württemberg in 1815-16*. After two years at Heidelberg Hegel accepted the renewed offer of the chair of philosophy at Berlin, which had been kept vacant since the death of Fichte.

During his thirteen years at Berlin Hegel's whole soul seems to have been in his lectures. Between 1823 and 1827 his activity reached its maximum. His notes were subjected to perpetual revisions and additions. We can form an idea of them from the shape in which they appear in his published writings. During these years hundreds of hearers from all parts of Germany, and from beyond the Fatherland, came under his influence. His fame was carried abroad by eager or intelligent disciples. At Berlin Henning served to prepare the intending disciples for fuller initiation by the master himself. Gans and Hotho carried the method into special spheres of inquiry. At Halle Hinrichs maintained the standard of Hegelianism amid the opposition or indifference of his colleagues. Three courses of lectures are especially the product of his Berlin period: those on æsthetics, the philosophy of religion, and the philosophy of history. One of the last literary undertakings in which Hegel took part was to give his support to Gans and Varnhagen von Ense in the establishment of the Berlin *Jahrbücher für Wissenschaftliche Kritik*. The aim of this review was to give a critical account, certified by the names of the contributors, of the more important literary and philosophical productions of the time, in relation to the general progress of knowledge.

The revolution of 1830 was a great blow to him, as to many other Germans; and the prospect of democratic

advances almost made him ill. His last literary work was an essay on the English Reform Bill of 1831, the first part of which appeared in the *Preussische Staatszeitung*. He died November 14, 1831.

HEIBERG, JOHAN LUDVIG, Danish poet and critic, was the son of the political writer Peter Andreas Heiberg, and of the famous novelist, afterward the Baroness Gyllembourg-Ehrensward. He was born at Copenhagen, December 14, 1791. In 1812 he visited Sweden, and made a long stay in Stockholm; he afterward sent to his mother from Upsala the first important poem which he composed, *The Return Home*, a piece of remarkable strength and brightness. In 1813 his first publication appeared, a romantic drama for children, entitled *The Theater for Marionettes*. This was followed by *Christmas Jokes and New Year's Tricks* in 1816, *The Initiation of Psyche*, 1817, and *The Prophecy of Tycho Brahe*. In 1817 Heiberg took his degree, and in 1819 went abroad with a grant from government. He proceeded to Paris, and spent the next three years there, under his father's roof. In 1822 he published his drama of *Nina*, and was made professor of the Danish language at the university of Kiel. At this town he delivered a course of lectures, comparing the Scandinavian mythology as found in the *Edda* with the poems of Oehlenschläger. In 1825 Heiberg came back to Copenhagen for the purpose of introducing the vaudeville on the Danish stage. In 1828 he brought out the national drama of *Elverhøi*, in 1835 the comedy of *The Elves*, and in 1838 *Fata Morgana*. In 1841 Heiberg published a volume of *New Poems*, containing "A Soul after Death," which is perhaps his masterpiece, "The Newly Wedded Pair," and other pieces. All this time he had been busily engaged in editing the famous journal *The Copenhagen Flying Post*, which he founded in 1827 and continued until 1837. In 1831 he married Johanne Louise Pætges, the greatest actress that Scandinavia has produced. Heiberg's scathing satires at last began to make him very unpopular; and this antagonism reached its height when, in 1845, he published his little malicious drama of *The Nut Crackers*. Notwithstanding this he received in 1847 the responsible post of director of the national theater, for which indeed he was more eminently fitted than any other living person. He filled it for seven years. Heiberg died at Bonderup, near Ringsted, on August 25, 1860.

HEIDE, a town of Prussia, chief town of the circle of North Ditmarsh, province of Schleswig-Holstein, is situated on a small plateau which stands between the marshes and moors bordering the North Sea, thirty-five miles north-northwest of Glückstadt. Population, 7,000.

HEIDEGGER, JOHN HENRY, theologian, was born at Bärentschweil, in the canton of Zurich, Switzerland, in 1633, and died in 1698.

HEIDELBERG, a German university city in the Baden circle and jurisdiction of the same name, lies at the foot of the Castlehill, a spur of the Königsstuhl on the south bank of the Neckar, about twelve miles from the junction of that river with the Rhine. The situation of the town is one of romantic beauty. The town primarily consists of one long narrow street, the Hauptstrasse. To the south of this the Anlage, a pleasant promenade flanked with fine houses and gardens, leads directly from the chief station to the center of the town. A number of smaller streets run up from the river, intersecting the Hauptstrasse at right angles. On the other side of the Neckar the Heiligenberg, a vine-clad hill wooded toward the summit, crowned with the ruins of an old chapel, rises abruptly from the river bank.

Of the churches the chief are the Peterskirche (founded before 1392), where Jerome of Prague in 1460 expounded the Reformed doctrines; the Heiligegeistkirche;

erected at the beginning of the fifteenth century, of which the nave is used for Protestant, the choir for Old Catholic worship; and the Jesuitenkirche, with sumptuously decorated interior. The rathhaus, the museum, and the university (1712) are large but common-place erections. The chief building at Heidelberg, and, indeed, its chief attraction for strangers, is the famous castle which overhangs the west part of the town. It is situated on the Castlehill, more properly called the Jettenbuhel, 330 feet above the Neckar. Though now a ruin, yet its extent, its magnificence, its beautiful situation, its interesting history, render it by far the most noteworthy, as it certainly is the grandest and largest, of the old castles of Germany. The castle contains an interesting antiquarian museum formed by the Count Graimberg, and the celebrated Great Tun, which was built in 1751, but has been only used on one or two occasions. Its capacity is 49,000 gallons.

The university of Heidelberg is the oldest in the German kingdom. It was founded in 1356 by the elector Rupert, but it was not till 1386, when it obtained papal sanction, that its real life begins. It was constructed after the type of Paris, had four faculties, and possessed numerous privileges. Marselius von Inghen was its first rector. Frederick the Victorious, Philip the Upright, and Louis V. respectively cherished it. Otto Henry gave it a new organization, further endowed it, and founded the library. At the Reformation it became a stronghold of Protestant learning. The famous Heidelberg catechism was drawn up by its theologians. Damaged by the Thirty Years' War, it led a struggling existence for a century and a half. A large portion of its remaining endowments were cut off by the peace of Lunéville (1801). In 1803, however, the elector Charles Frederick raised it anew, and reconstituted it under the name of "Ruperto-Carolina." At present (1890) it has thirty-eight ordinary and twenty-six extraordinary professors. The students number about 500 in winter, and from 800 to 900 in summer. In 1703 the new library was founded; it has now nearly 500,000 volumes, besides 4,700 valuable MSS. Population of Heidelberg (1885), 24,417.

HEILBRONN, a town of Würtemberg, in the circle of the Neckar, is situated in a pleasant and fruitful valley on the Neckar, and at the junction of several railways, twenty-six miles north of Stuttgart. The population is 22,000.

HEILIGENSTADT, a town of Prussian Saxony, government district of Erfurt, is situated on the Leine and on the railway from Halle to Cassel, thirty-two miles east-northeast of Cassel. Population, 6,000.

HEILSBERG, a town of Prussia, capital of a circle in the government district of Königsberg, is situated at the junction of the Simser and Alle, thirty-eight miles south of Königsberg. Population, 6,000.

HEILSBRONN, or KLOSTER-HEILSBRONN, a market-village in the Bavarian government of Middle Franconia, with a station on the railway between Nuremberg and Ansbach.

HEIM, FRANÇOIS JOSEPH, French painter, belongs to that group of painters in whose works we find the special characteristics of the Restoration. Born at Belfort on December 16, 1787, he early distinguished himself at the École Centrale of Strasburg, and in 1803 entered the studio of Vincent at Paris. In 1807 he obtained the first prize, and in 1812 his picture of *The Return of Jacob* (Musée de Bordeaux) won for him a gold medal of the first class, which he again obtained in 1817, when he exhibited, together with other works, a *St. John*—bought by Vivant Denon. In 1819 the *Resurrection of Lazarus* (Cathédral Autun), the *Martyrdom of St. Cyr* (St. Gervais), and two scenes from the life of

Vespasian (ordered by the king) attracted attention. In 1823 the *Reërection of the Royal Tombs at St. Denis*, the *Martyrdom of St. Laurence* (Notre Dame), and several full-length portraits increased the painter's popularity; and in 1824, when he exhibited his great canvas, the *Massacre of the Jews* (Louvre), Heim was rewarded by the legion of honor. In 1827 appeared the *King Giving Away Prizes at the Salon of 1824* (Louvre—engraved by Jazet)—the picture by which Heim is best known—and *Saint Hyacinthe*. Heim was now commissioned to decorate the Gallery Charles X. (Louvre), work for which he was thought eminently fit. Heim replaced Regnault at the Institute in 1834, shortly after which he commenced a series of drawings of the celebrities of his day, which are of much interest. His decorations of the Conference room of the Chamber of Deputies were completed in 1844; and in 1847 his works at the Salon—*Champ de Mai* and *Reading a Play at the Théâtre Français*—were the signal for attacks maintained with great violence. In 1851 Heim was awarded the great gold medal, and in 1855—having sent to the Salon no less than sixteen portraits, among which may be cited those of *Cuvier*, *Geoffrey de St. Hilaire*, and *Madame Hersent*—he was made an officer of the legion of honor. In 1859 he again exhibited a curious collection of portraits, sixty-four members of the Institute arranged in groups of four; and six years later, on September 29, 1865, he died, at the age of seventy-eight.

HEINE, HEINRICH, poet and journalist, was born on December 13, 1799, at Düsseldorf, of Jewish parents. Heine received the rudiments of his education at the gymnasium or *lycée* (as it was called during the foreign occupation) of his native town, and acquired while there a good knowledge of French and English, as well as some tincture of the classics and Hebrew. But if the influence upon him of his teachers and their teaching was unimportant, not so was that of the public events amidst which he grew up. His early years coincided with the most brilliant period of Napoleon's career; and the boundless veneration which he is never tired of expressing for the emperor throughout his writings shows that his true schoolmasters were rather the drummers and troopers of a victorious army than the Jesuit fathers of the *lycée*. Heine entered the university of Bonn in the spring of 1819. During his stay there he was an eager student, but the subjects to which he devoted himself had no connection with the profession of law which had been chosen for him. He seems to have attended no lectures save those on literature and history—notably A. W. von Schlegel's; and he not long afterward acknowledged his obligations to Schlegel by dedicating a sonnet to him—a tribute which he recalled in later days by a wanton and outrageous attack upon the veteran critic in *Die Romantische Schule*. Why Heine left Bonn does not clearly appear, but it is at Göttingen that we find him in the autumn of 1820. His stay here was even shorter than at Bonn. In February, 1821, the authorities of the "Georgia Augusta" rusticated him for some infraction of the dueling laws. Although from these beginnings Heine's academical career promised to pursue no very even course, he nevertheless determined, after his residence at Göttingen had been cut short, to seek a third university; and it was to Berlin that he now repaired, where Hegel was at the zenith of his renown. He began to contribute poems to the *Berliner Gesellschafter*, many of which were subsequently incorporated in the *Buch der Lieder*, and in 1822 a volume came from the press entitled *Gedichte von Heinrich Heine*, his first avowed act of authorship. He was still further employed at this time as the correspondent of a Rhenish newspaper, as well as in completing his tragedies *Almansor* and *William Ratcliff*, which were pub-

lished in 1823 with small success. He was now, indeed, fairly embarked upon his literary course. But he was still largely dependent upon his uncle; and in order so far to fulfill his engagements toward his benefactor, he returned to Göttingen in 1825, and shortly afterward took his degree in law, having previously qualified himself for practice by publicly professing Christianity.

Heine seems never to have made any serious attempt to practice law. His life from the year 1826 until his death was devoted entirely to literature, and more especially to journalism, which alone indeed was the main source of his income for many years. At first he lived in Hamburg, and then it was that, besides the *Buch der Lieder*, the earlier portions of the *Reisebilder* appeared, both of which, but particularly the latter, at once created an immense sensation throughout Germany, not only among the youthful and enthusiastic, who found their own sentiments expressed by the new writer with the happiest audacity, but among such dignified and *rangés* personages as Metternich and Gentz. In 1827 Baron Cotta, the Bavarian publisher, offered Heine, who had risen at a bound into celebrity, the joint-editorship of the *Allgemeine Politische Annalen*. The young author accepted the offer, and betook himself to Munich in the winter of that year, after having paid a visit to London. He remained for a considerable period in the South German capital, and it was owing, not to any disagreement with his employer, but to the demands of the court of Prussia, which was not long in taking umbrage at his freedom of opinion, that his editorial function ceased so abruptly as it did. What the secret history of the next two or three years of his life was — whether from the very first he really was an object of especial disfavor at Berlin, or whether, as is quite as likely, taking his vanity and love of publicity into account, he exaggerated his powers of offense beyond the endurance of the government there, and forced it into what seemed a petty persecution — he presently perceived that he must either quit Germany altogether or prepare for a lifetime, perhaps, of fortress-imprisonment. He did not long hesitate between these two alternatives, and on May 1, 1831, Heinrich Heine left his native land for Paris, where he lived for the rest of his life, only once recrossing the Rhine, in 1843.

After settling in his new home, where his life for many years must have been as gay and brilliant as latterly it was sad and somber, and where he speedily became more or less intimate with such writers as Balzac, Dumas the elder, George Sand, Victor Hugo and Théophile Gautier, Heine devoted himself more exclusively than ever to journalism; and from 1831 until 1847, he was an active and indefatigable publicist. In 1839 *Shakespeare's Mädchen und Frauen* appeared — Heine acting in this slight work as cicerone through a gallery of Shakespeare's heroines. The year 1840 was signalized by the publication of *Heinrich Heine über Ludwig Börne*, a brochure of the wittiest and most trenchant satire, in which the German refugees in Paris — a fraternity whom Heine always anxiously avoided — were far more severely handled than was the defunct agitator whose name it bore, and who, it may be noted, was himself a Jew. In 1844 *Deutschland, ein Wintermärchen*, came forth — the result of the visit to Germany which has been alluded to as the sole journey of the kind which Heine undertook; and this effusion may be ranked, along with a similar performance, *Atta Troll* (1846), as belonging to his most inferior writings. It was in 1848 that Heine, in the very heyday of his activity, and with gigantic projects seething within him for the foundation of a journal, was suddenly prostrated by the disease which carried him off seven years later. His sufferings throughout that time are reported to have

been frequently excruciating, and he at length grew so habituated to the use of opium that the very largest doses failed to afford him relief. But when his malady — a softening of the spinal cord — allowed him a respite, his intellect was as clear and vivacious as ever; and it is to these closing years of his life, harassing as they were, that we are indebted for the finest and most finished of all his poems. He died February 17, 1856.

HEINECCIUS, JOHANN GOTTLIEB, a celebrated jurist, was born in 1681 at Eisenberg. He studied theology at Leipsic and law at Halle; and at the latter place he was appointed in 1713 professor of philosophy, in 1718 extraordinary, and in 1720 ordinary professor of jurisprudence. He subsequently filled legal chairs at Franeker in Holland, and at Frankfort, but finally returned to Halle in 1733 as professor of philosophy and jurisprudence. He died there, August 31, 1741.

HEINECKEN, CHRISTIAN HEINRICH (1721–1725), a child remarkable for extraordinary precocity of intellect. Able to speak at the age of ten months, by the time he was one year old he knew by heart the principal incidents in the Pentateuch. At two years of age he had mastered all sacred history; at three he was intimately acquainted with history and geography, ancient and modern, sacred and profane, besides being able to speak French and Latin; and in his fourth year he devoted himself to the study of religion and church history.

HEINSE, JOHANN JACOB WILHELM (c. 1746–1803), German romance writer, was born at Langenwiesen in the Thuringian Forest in 1746, and died in 1803.

HEINSIUS, or HEINS, DANIEL, one of the most famous scholars of the Dutch Renaissance, was born at Ghent in 1580. The troubles of the Spanish war drove his parents to settle first at Veere in Zealand, then in England, next at Ryswick, and lastly at Flushing. In 1594, being already remarkable for his attainments, he was sent to the university of Franeker to perfect himself in Greek under Henricus Schotanus. At Leyden he studied under Joseph Scaliger, and there he found Marnix de St. Aldegonde, Janus Douza, Paulus Merula, and others, and was soon taken into the society of these celebrated men as their equal. His proficiency in the classic languages won the praise of all the best scholars of Europe, and offers were made to him, but in vain, to accept honorable positions outside Holland. He soon rose in dignity at the university of Leyden. In 1602 he was made professor of Latin, in 1605 professor of Greek, and at the death of Merula in 1607 he succeeded that illustrious scholar as librarian to the university. The remainder of his life is recorded in a list of his productions. He died at the Hague in 1655.

HEINSIUS, NIKOLAES (1620–1681), Dutch scholar, was the son of Daniel Heinsius, and scarcely less illustrious than his father.

HEINSIUS, NIKOLAES, an illegitimate son of the subject of the last article, was born in 1655 at the Hague. At the age of twenty he wrote *The Delightful Adventures and Wonderful Life of Mirander*, the sole original romance produced in Holland during the seventeenth century.

HEIR. See INHERITANCE.

HELDER, or THE HELDER, a township of the Netherlands at the northern extremity of the province of North Holland, directly opposite the island of Texel. Since 1819 it has been the terminus of the North Holland canal, and is now connected (since 1865) by railway with Alkmaar and Haarlem. Its fortifications and its dykes are both constructed on an extensive scale, the former comprising four batteries and five forts, and the latter being the most striking on the whole coast. A garrison of 7,000 to 9,000 men

is necessary for the defense of the place, and 30,000 men could be accommodated within the lines. The harbor, called the Nieuwe Diep, is one of the best in Europe. Its area is 6,560 feet long by 330 to 490 broad, and it has depth enough for the largest vessels, which are admitted to the North Holland Canal by the Koopvaarders sluice. The government arsenal comprises an extensive wet dock, a dry dock, and auxiliary establishments. Population, about 25,000.

HELENA, daughter of Zeus and of Leda the wife of Tyndareus king of Sparta, was sister of Castor, Pollux, and Clytemnestra, and was married to Menelaus. According to Homer she was obliged by Aphrodite to flee with Paris to Troy; and after the Trojan War she returned with Menelaus and lived with him as queen in Sparta. She had only one child, a daughter named Hermione, who was married to Neoptolemus. In the Homeric poems her character is drawn with marvelous skill; forced by the gods to do what she regrets, she seems to be separated from the wrong that she does, and remains always an object of interest and respect. Goethe (*Faust*, part ii.) introduces Helena apparently to symbolize the Greek spirit acting on the modern mind. Among later poets the tales of Helen are much more complicated. She was carried off by Theseus to Attica in her childhood, but was recovered by her brothers. Her character often suffers much in the tales followed by lyric and tragic poets. Stesichorus and Euripides (*Helena*), however, relate that Paris on his homeward voyage was driven by stress of wind to Egypt. Proteus, king of Egypt, learning the facts, detained the real Helen in Egypt, while a shadowy Helen was taken to Troy and fought for. Menelaus on his way home from Troy was also driven to Egypt, and there found his true wife.

HELENA, SAINT, a woman of humble origin, said to have been the daughter of an innkeeper, was the wife of Constantius Chlorus. Of her nationality nothing certain is known. She had one son, Constantine the Great. In 292 A.D. Chlorus was raised to the purple by the emperors Diocletian and Maximian, and forced to divorce Helena to make room for a more noble wife. After her son became emperor she was treated with great respect and styled Augusta, and cities in Bithynia and Lysia were after her named Helenopolis. She became a Christian when her son was converted, and during a pilgrimage to Jerusalem she claimed to have discovered the holy sepulcher and the true cross.

HELENA, the capital of Montana, also of the county of Lewis and Clarke, is situated in what is known as Prickly Pear valley, at the base of the Rocky mountains, and within easy distance of the Missouri river. The railway facilities include the Northern Pacific, Manitoba and Union Pacific systems, the latter company operating a branch road between Helena and Butte City where connection is made with the main line. In addition to these, there are a number of local roads, together with street railways and electric roads in operation between the city centers and the suburbs surrounding. The city contains five banks, churches of all denominations, two daily and several weekly papers, five schools, two academies conducted under the auspices of the Catholic Church, also a Protestant Episcopal School, a court house, completed at a cost of \$250,000; three libraries, the United States Land and Assay offices, a smelter with a daily capacity of sixty-five tons of silver bullion, reduction works, also manufacturing of woollens, lumber, tile, trunks, flour, cornices, metal roofing, tinware, iron castings, etc. The government of the city is vested in a mayor and common council, and the departments of fire, police, water, sewerage, etc., are well ordered and maintained. In

the immediate vicinity of Helena are mines of gold and silver, marble, granite, coal, etc., all of exceptional richness, and within four miles of the city are a series of hot springs, the waters of which possess recuperative properties of great excellence. The city is growing rapidly in extent and population, and the improvements proposed and completed are of the most substantial and expensive character. The population according to the latest data is 23,834.

HELENA, an Arkansas town, the county seat of Phillips county, is situated on the Mississippi river about eighty miles below Memphis, on the opposite bank. The most of the trade of the town is in cotton seed oil, agricultural implements, farm produce, etc. The town has railroad connections, banks and telegraphs. It is slowly growing in population and commerce, and its inhabitants numbered in 1890 (U. S. census), 5,185.

HELENSBURGH, a town and favorite watering-place of Dumbartonshire, Scotland, is situated at the mouth of the Gareloch, a branch of the Firth of Clyde, opposite Greenock, which is about four miles distant. It is twenty-four miles northwest of Glasgow. Population (1890), 12,000.

HELIAND (*i.e. Heiland*) is an Old Saxon poem of the ninth century. According to some critics it is a fragment of a larger work which dealt with the entire historical material of the Old and New Testaments. The part which we now possess sets forth the life of Christ as told by the four evangelists, whose various narratives the author seeks to harmonize.

HELICON, a mountain, or more strictly a mountain range, of Bœotia in ancient Greece, celebrated in classical literature as the favorite haunt of the Muses, is situated between Lake Copais and the Gulf of Corinth. On the fertile eastern slope stood a temple and grove sacred to the Muses, and adorned with beautiful statues, which, taken by Constantine the Great to beautify his new city, were consumed there by a fire in 404 A.D. Hard by sparkled the famous fountains of poetic inspiration, Aganippe and Hippocrene, and latter fabled to have gushed from the earth at the tread of the winged horse Pegasus, whose favorite browsing place was there. At the neighboring Ascrea dwelt the ancient Hesiod, a fact which probably enhanced the fame of the region.

HELIGOLAND (German *Helgoland*), *Heiligeland*, or *Hellige Land*, is one of the Frisian Islands, and formerly an English possession, situated in the North Sea, thirty-six miles from Cuxhaven at the mouth of the Elbe, and about 100 from Hamburg. Though the red cliffs of the Rock Island are most familiar to the voyager entering the Elbe, there are in reality two islets, the second being the Dune or Sand Island, now lying a quarter of a mile east of the main one, though at one time connected with it by *de waal*, a neck of land which the sea broke through and destroyed in 1720. On this islet there are some 500 houses, divided into a lower town or *Unterland*, on the spit, and an upper town or *Oberland*, situated on the cliff above and connected with the lower town by a wooden stair of 190 steps, the only possible mode of communication between the two sections. There is also a lighthouse; but, though a few guns are placed behind a rude earthwork, there are no fortifications except the inaccessible cliffs of the island, and no garrison of any kind unless a few coast-guardsmen be considered as such. The greatest length of the island, which slopes somewhat from west to east, is 5,880 feet, and the greatest breadth 1,845 feet, its circumference 13,500 feet, its average height 198 feet, and the highest point 216 feet. The Dune or Sand Island is little more than a sand-bank covered with scanty herbage, and imperfectly

bound together by bent, grass, and carices. It is only about 200 feet above the sea at its highest point, but the drifting sands and the constant inroads of the sea make the height rather variable.

During the summer from 2,000 to 3,000 people visit the island for sea-bathing. Most of these are from Hamburg, English or other guests being rare. There are no English residents, the officials, the governor excepted, being either natives or Germans; and German, when Frisian is not employed, is the official language, though for form's sake on the postage stamps English and German words appear in duplicate. The natives speak a dialect of Frisian, barely intelligible to the other islands of the group. On June 18, 1890, the English premier, the marquis of Salisbury, announced in parliament that, by the terms of a treaty that day concluded, Heligoland had been transferred to Germany.

HELIODORUS, son of Theodosius, was born at Emesa in Syria, in the second half of the fourth century. He belonged to a family of priests of the Syrian sun-god Elagabalus, but he was himself a Christian, and became bishop of Tricca in Thessaly. He is famous as the author of the best of the Greek love-romances. It is called *Æthiopica*, as it relates the history of Chariclea, daughter of Hydaspes, king of Æthiopia, her love for Theagenes, a Thessalian of high rank, and the happy issue after a series of exciting adventures and hairbreadth escapes.

HELIOGABALUS, a Græcized form of Elagabalus, the name of a Syrian deity, was the name adopted by Varius Avitus Bassinus, the Roman emperor.

Heliogabalus was in 218 recognized by the senate as emperor. After spending the winter in Nicomedia, he proceeded in 219 to Rome. He made it his business to exalt the honor of the deity whose priest he was. The Syrian god was proclaimed the chief deity in Rome, and all other gods his servants; splendid ceremonies in his honor were celebrated, at which Heliogabalus danced in public; and it was believed that secret rites, accompanied by human sacrifice, were performed in his honor. The shameless profligacy of the emperor's life was such as to shock even a Roman public. His popularity with the army declined, and Mæsa, perceiving that the liking of the soldiers inclined to Alexander Severus, persuaded him to raise his cousin to the dignity of Cæsar (221). Heliogabalus soon repented of this step. An attempt to murder Alexander was frustrated by the watchful Mæsa. Another such attempt in 222 produced a mutiny among the soldiers, in which Heliogabalus and his mother, Soæmias, were slain.

HELIOGRAPHY is the name applied to the method of communicating between distant points in which visual signals are obtained by reflecting the rays of the sun from a mirror or combination of mirrors in the required direction. In favorable localities heliography possesses important advantages for military signaling over other methods, the principle being the portability of the apparatus, the great distance to which messages can be sent without retransmission, and the fact that the signals are visible to those only who are on the direct line of signaling.

The signals are produced by causing the reflected beam to appear and disappear or be obscured alternately at the distant point, the intervals of appearance and obscuration being usually varied in length, so as to produce the combinations of long and short signals known as the Morse alphabet. This is done in two distinct ways. In the first of these, known as signaling by "appearance," the reflected beam or "flash" is obscured from the receiving station except when a message is being transmitted, the flashes then giving the

signals or "dots" and "dashes;" while in the second method, or signaling by "obscuration," the flash is kept continually on the receiving station, and only obscured for intervals forming signals. The first method is more easily read by learners; the second is less fatiguing to the eyes, and possesses the advantage of enabling the signalist to correct the adjustment of his instrument at any time. Glass mirrors with a plane surface are employed, hence the angle of divergence of the extreme rays in the reflected beam is the same as that subtended by the sun's diameter at the point, or about thirty-two minutes of arc; this small divergence rendering the flash visible to great distances.

The distance through which signaling by this method can be carried on depends on the size of the mirror employed and the angle of reflection of the rays, a larger mirror giving a more intense "flash" than a small one, since it reflects more rays, and being therefore visible to a greater distance; also when the angle of reflection is nearly a right angle the flash will be more intense than when the rays are only diverted through a small angle from the greater extent of surface exposed to the sun's rays. The range, however, depends to so great a degree on the state of the atmosphere that it is impossible to assign any limits to the distance that the flash might be seen through in exceptionally clear weather. From the Himalayas a five-inch mirror has been found to give very distinct signals over a distance of sixty miles; but when the air was at all misty a very much larger mirror had to be employed. The more perfect reflection when the angle between the direct and reflected rays is large is not sufficient to compensate for the loss of intensity caused by the small number of reflected rays. Hence when this angle is greater than a right angle two mirrors are used, the sun's rays being reflected from one back to the other and thence to the distant point. This is called the duplex method of working.

HELIOPOLIS. See BAALBEC and EGYPT.

HELIOTROPE, or TURNSOLE, *Heliotropium*, L., a plant which follows the sun with its flowers and leaves, or, according to Theophrastus, which flowers at the summer solstice, a genus of usually more or less hairy herbs or undershrubs of the tribes *Heliotropiceæ* of the natural order *Boragineæ*, having alternate, rarely sub-opposite leaves; small white, lilac, or blue flowers, in terminal or lateral one-sided simple or once or twice forked spikes, with a calyx of five deeply divided segments, a salver-shaped, hypogynous, five-lobed corolla, and entire four-celled ovary; fruit two to four sulcate or lobed, at length separable into four one-seeded nuts, or into two hard two-celled carpels; and seeds generally with a scanty albumen. In some species the cone surmounting the stigma is bearded. The heliotropes are indigenous mostly to tropical and subtropical regions, but a few species are natives of Europe.

HELIOTROPE, or BLOODSTONE, a cryptocrystalline variety of quartz, dark green in color, with small spots of red jasper, resembling drops of blood. It is used for signet rings and a variety of ornamental articles.

HELL. See ESCHATOLOGY.

HELLANICUS, the most important of the Greek logographers, was a native of Mytilene. His father was named Andromenes or Aristomenes. His life, which lasted eighty-five years, extends over the fifth century B.C., but the date of his birth is uncertain, and the circumstances of his career are unknown.

HELLEBORE, a genus of plants of the natural order *Ranunculaceæ*, natives of Europe, Western Asia, and North America. The leaves are palmate or pedate, are usually solitary, and have five persistent petaloid sepals, within the circle of which are placed the minute

gland-like tubular petals, the nectaries of Linnæus, of the form of a horn with an irregular opening, and representing, according to Baillon, "the lower or outermost stamens transferred into staminodes." The stamens are very numerous, and are spirally arranged; and the carpels are variable in number, sessile or stipitate, and slightly united at the base, and dehiscence by ventral suture.

Of the numerous species of hellebore now grown, the deep-purple-flowered *H. colchicus* is one of the handsomest. *H. atropurpureus*, introduced in 1844, blooms in March or at the end of February, and may be effectively used in flower borders to succeed hepaticas, scillas and crocuses.

The rhizome of *H. niger* occurs in commerce in irregular and nodular pieces, from about one to three inches in length.

HELLENISTS was the name usually applied by those who called themselves Greeks (Hellenes) to all Græcizing and more especially to all Greek-speaking foreigners,—a class which, after the conquests of Alexander the Great, formed a large and important element in almost every community throughout the civilized world. More particularly the word is applied in the New Testament to Greek-speaking or "Grecian" Jews, who, besides being very numerous in the various countries of the dispersion, had also many synagogues in Jerusalem, and were remarkable there for their zeal.

HELLESPONT, the modern DARDANELLES, is variously named in classical literature Hellespontus, Pontus Helles, Hellespontum Pelagus, and Fretum Hellesponticum. It received its name from Helle, in Greek mythology, daughter of Athamas, king of Orchomenus in Boeotia, and of the goddess Nephele, whom he had married at the command of Hera (Juno). Athamas, however, secretly loved the mortal Ino, and, on his marrying her also, the dissensions between his wives became so great that he went to consult the Delphic oracle. The priestess there, bribed by Ino, assured him that the sacrifice of Phrixus, the brother of Helle, was necessary to domestic harmony; but Nephele, in order to save her children, dispatched them to Colchis, in Asia, on the back of the ram with the golden fleece. Helle, however, had the misfortune, when crossing this strait, to slip from her seat, and to be carried away by the current—hence the name *Hellespontus*, or "Sea of Helle."

HELL-GATE IMPROVEMENTS. For a great many years the obstructions to the entrance of New York harbor, at the junction of Harlem and East Rivers, had been a source of annoyance and danger to shipping, many vessels annually being damaged by collision with these hidden or partially hidden barriers, against which they were hurled by the current, made all the more violent by being pent up from the resistance afforded by the reefs. The number of vessels grounding was enormous, at times averaging thirty a month. The first attempt to remove these rocks was made in 1851, by surface blasting, a process which consisted of putting explosives on the surface of the reefs and firing them by a voltaic current. The detritus was not dredged away, it being thought that the current would wash them from the vicinity of their parent nucleus. The expense of the operation was borne by private subscription among the merchants and citizens of New York. The rocks thus attacked were Pot rock, where a depth of over eighteen feet was attained; Frying Pan rock, which was lowered to about sixteen feet; Way's reef, which gave a depth of fourteen feet; Baldheaded Billy, which was destroyed entirely; Sheldrake rock, which allowed a depth of sixteen feet, and Diamond rock, which was lowered two feet, then giving a depth of eighteen feet. The cost of these improvements was

about \$15,000, the destructive agents employed consisting almost entirely of blasting powder. This work, although alleviating the situation to some degree, was found inadequate for the demands of first-class vessels, and after considerable delay, the general government was induced to make a small appropriation to continue the work and render more effective the improvements thus begun. The civil war was at that time the thought paramount in the minds of the people, and it was not until this matter had been disposed of that anything of consequence was attempted. The first work under the auspices of the national government was begun in 1852, when the sum of \$20,000 was appropriated, and the depth of twenty-one feet was reached over Pot rock. As before stated, the political agitation of the country hindered the work, and the next important date in the history of the removal is 1866. At this time General Newton proposed a plan which, as afterward modified, was successful. His perfected plans necessitated the use of a floating platform or scow with an opening thirty-two feet in diameter in its center, through which an iron hemispherical bell was lowered to the rock below; in this bell the drills were placed and the bores for the blasting charges were made. Then the cartridges of nitro-glycerine were inserted, and the connections with the firing batteries made by divers, when the scow was floated away and the charges fired. By 1880 the work on the Diamond reef was completed, the broken pieces of rock being dredged and carried away. Coenties reef, Frying Pan, Pot rock, and Way's reef received similar treatment, as did also Flood rock, with (in the latter case) some slight variations, but in accordance with the plans and under the supervision of General Newton.

The removal of rock at Hallet's Point was accomplished in a different manner, the principal features of which were the sinking of a shaft on the shore, from which tunnels or galleries were driven out under the rock and charged with explosives and fired. The destruction of these various barriers was attained at a cost of nearly \$5,000,000, and the result was an average depth of twenty-six feet at mean low tide. The work was attended with extreme difficulty, and its successful accomplishment is a monument to the genius and perseverance of the men who undertook it. About nine acres of rock were removed, and the terrors of this formerly dangerous passage have been almost entirely obviated. The most modern methods were used in the different processes, and the experience of the engineers in this work has formed a valuable addition to the knowledge of submarine operators.

Delays at times were unavoidable, and the cost of the work was thereby increased, but in general terms the outlay may be said to have been justified and returned many times over by the benefits resultant on its accomplishment.

HELLIN, a town of Spain, in the province of Albacete, is situated on the slope of the Sierra de Segura, thirty-five miles south-southeast of Albacete. The population is about 8,000.

HELMERS, JAN FREDERIK, Dutch poet, was born at Amsterdam, March 7, 1767. His poems, published in 1809 and 1810, but especially his great work, *The Dutch Nation* (1812), created much enthusiasm and enjoyed immense success. Helmers died at Amsterdam, February 26, 1813.

HELMET, or HELM, is the term used in a general sense to include the various forms of head defenses, which were either made in solid metal or of metal plates. The form of helmet used among the Assyrians, as shown by the monumental sculptures, was a close-fitting skull-cap, round or conical, sometimes surmounted by a

crest rising from the summit of the cone and curving forward in a semicircular form. The Greek helmet was also in its simplest form a skull-cap, covering the head in front above the level of the eyes, but reaching down to the nape of the neck from ear to ear. The Etruscan helmet differed but slightly from that of the Greeks. It was more conical in form, and often furnished with horns or wings in place of a crest. The Roman helmet was usually a skull-cap, with or without crest, and often plain or undecorated. The Gaulish helmet, of which a beautiful specimen was obtained from an Iron Age burial at Berru, in Marne, in 1872, was of hammered iron, conical in shape, terminating in an ornamental apex, and having a richly decorated border round the lower part. Conical helmets of an earlier character found at Theil and Auxonne have been assigned to the Age of Bronze. The helmets worn by the Normans and Saxons at the time of the Conquest, as shown in the Bayeux tapestry, were conical in shape with a projecting nasal. In the end of the fifteenth century the great helm was superseded by the smaller headpiece with movable vizor and beaver or chin-piece and neck-guard, which is properly styled a helmet. Other varieties of headpiece were the bascinet, of a plain oval form pointed at the top and somewhat compressed on the sides, having holes at the bottom for the attachment of the camail or gorget of chain-mail. The bascinet was sometimes worn alone, and sometimes under the helm. It was succeeded in the fifteenth century, by the *salade*, a lighter skull-cap with the hinder part projecting, and occasionally a movable vizor. The *armet*, the *burgonet* and the *casque* are varieties of the lighter form of headpiece, partaking more or less of the skull-cap form, while the *morion* and the *chappelle de fer* were distinguished by their flattened brims.

HELMOND, a town of the Netherlands, in the province of North Brabant, to the left of the River Aa, with a station on the state railway between Venloo and Eindhoven. Population, 7,000.

HELMONT, JEAN BAPTISTE VAN, was born at Brussels in 1577. He was educated at Louvain, and began the study of natural science under the Jesuits in that city. He graduated as M.D. in 1599, and made some useful discoveries in applied medicine. He died in Holland in 1644, in the sixty-seventh year of his age.

HELMSTÄDT, or HELMSTEDT, a town of Germany in the duchy of Brunswick, is situated on the railway from Magdeburg to Brunswick, twenty-three miles east of Brunswick. Population, 8,000.

HELOISE. See ABELARD.

HELOTS, in Grecian antiquity, were the serfs or bondsmen of the Spartans. The most probable of the various explanations of their origin seems to be that they were the early aborigines of Laconia, who, at the time of the Dorian invasion, were reduced to slavery by the conquerors. The Helots were the lowest class of the inhabitants of Sparta; but those of them who were emancipated formed the class of *Neodamodes*, next in political rights to Spartan citizens themselves. The *Mothones* or *Mathakes* were domestic slaves, who had been brought up along with the young Spartans, and afterward liberated. The Helots were the property of the state, which alone had a right of emancipating them, although it made over their services to individuals. They were attached to the soil — *adscripti glebæ* — and could not be sold away from it. They were also employed on public works, and performed all domestic service. In time of war the Helots generally served as light-armed troops; but when, on special emergencies, they fought as *hoplites*, they were usually rewarded with

their freedom. The condition of the Helot was better than that of a slave in other Greek states; for, being a serf of the soil, he was not wholly at the mercy of his master, and there was a legal way whereby, after many stages, he could eventually obtain freedom and citizenship. After the Messenian war, however, when the multitude of the Helots made them formidable to the diminished number of the full citizens, there is no doubt that very cruel measures were adopted against them. The evidence is strong that the *Crypteia*, instituted ostensibly to inure the Spartan youth to hardship, was really intended to reduce the number of the Helots by assassination; and we know from Thucydides that on one occasion 2,000 Helots were treacherously massacred by the Spartan citizens.

HELPS, SIR ARTHUR, fourth and youngest son of Thomas and Ann Frisquett Helps, was born at Balham Hill, in the parish of Streatham and county of Surrey, on July 10, 1813. After the usual preliminary training at Eton, young Helps went to Trinity College, Cambridge, passing as B.A. in 1835, and taking his M.A. degree in 1839.

Soon after leaving the university, where he had established many valuable friendships, Arthur Helps became private secretary to Mr. Spring Rice (afterward Lord Monteagle), then chancellor of the exchequer in Lord Melbourne's administration. This appointment he filled till 1840, when he went to Ireland as the private secretary of Lord Morpeth (afterward earl of Carlisle), then the chief secretary of state for Ireland, where he remained until his principal left Ireland, in 1841, on the government passing from Lord Melbourne into the hands of Sir Robert Peel. When the clerkship of the Privy Council became vacant in 1860, on the resignation of the Hon. W. L. Bathurst, he was given the appointment.

During his early official career Helps cultivated literature with varying success. His *Essays Written in the Intervals of Business*, published in 1841, and his *Claims of Labor, an Essay on the Duties of the Employers to the Employed*, published in 1844, continue to interest, and are likely to keep their place in well-selected libraries. His two plays, *King Henry the Second, an Historical Drama*, and *Catherine Douglas, a Tragedy*, both published in 1843, have no particular merit. Helps possessed, however, just enough dramatic power to give life and individuality to the dialogues which he introduced with excellent effect to enliven many of his other books. His first effort in this direction was in *Friends in Council, a Series of Readings and Discourses thereon*, published in 1847 and 1851.

The subject of slavery was one which had a peculiar fascination for Helps. A long essay is devoted to it in the first series of *Friends in Council*. This was subsequently elaborated into a work in two volumes published in 1848 and 1852, called *The Conquerors of the New World and their Bondsmen*. Helps' interest in the subject led him into further investigations into the history of the conquest of America by the Spaniards, and he went to Spain in 1847 for the special purpose of examining the numerous MSS. bearing upon the subject at Madrid. The fruits of these researches were embodied in an historical work based upon his *Conquerors of the New World*, and called *The Spanish Conquest in America, and its Relation to the History of Slavery and the Government of Colonies*. This appeared in four volumes during the years 1855, 1857 and 1861.

From the time of his appointment as Clerk of the Council in 1860 to his death, Helps continued to add to the already considerable list of books, all dealing in one form or another with questions of social, sanitary, or

political reform. Helps edited and wrote an introductory preface to the series of extracts from the Queen's diary, which were published in 1868 under the title *Leaves from a Journal of Our Life in the Highlands*. In 1864 he received the honorary degree of D.C.L. from the university of Oxford. He was made a C.B. in 1871, and K.C.B. in the following year, and died March 7, 1875.

HELSEINGBORG, a town of Sweden, province of Skane and län of Malmö, is situated at the narrowest part of the Sound—there only three miles wide—opposite Elsinore, and thirty-two miles north-northwest of Malmö. Population (1890), 12,000.

HELSEINGFORS, chief city of the grand-duchy of Finland and the government of Nyland, in the district Helsing, on the Gulf of Finland, 274 miles by rail west of St. Petersburg. Population, 40,000.

HELST, BARTHOLOMÆUS VAN DER, was born in Holland at the opening of the seventeenth century, and died at Amsterdam in 1670. His first great picture, representing a gathering of civic guards at a brewery, is variously assigned to 1639 and 1643, and still adorns the town-hall of Amsterdam. His noble portraits of the burgomaster Bicker and Andreas Bicker the younger, in the gallery of Amsterdam, of the same date no doubt as Bicker's wife, lately in the Ruhl collection at Cologne, were completed in 1642. His likeness of Paul Potter at the Hague, executed in 1654, and his partnership with Backhuysen, who laid in the backgrounds of some of his pictures in 1668, indicate a constant companionship with the best artists of the time. It is needless to dwell on the pictures which preceded that of 1648, called the *Peace of Münster*, in the gallery of Amsterdam. The *Peace* challenges comparison at once with the so-called *Night-Watch* by Rembrandt, and the less important, but not less characteristic, portraits of Hals and his wife in a neighboring room.

HELSTON, a municipal and parliamentary borough and market-town of England, county of Cornwall, is situated on the declivity of a hill on the river Cober, nine miles southwest of Falmouth. Population, 9,000.

HELVETII. See SWITZERLAND.

HELVETIUS, CLAUDE ADRIEN, was descended from a family of physicians, the first of whom, John Frederick Schweitzer (Latinized into Helvetius), migrated from Germany to Holland about the year 1649, and became physician to the prince of Orange. His latter years were spent in the study of alchemy. His son, John Adrien, also a physician, went to Paris in the hope of establishing a sale for his father's drugs. He failed in this attempt, but introduced with the greatest success the use of ipecacuanha, then an unknown drug. His son, John Claude Adrien, who embraced the same career with even greater success, was appointed inspector-general of the military hospitals of Flanders and first physician to the Queen Marie Leezinska. His son, Claude Adrien, the future author of *De l'Esprit*, showed as a boy little aptitude for study, but was fond of desultory reading. He was elected a member of the academy of Caen, and when he was only twenty-three years of age had the good fortune to be appointed, at the queen's request, to a place as farmer-general. His philosophical studies ended in the production of his famous book *De l'Esprit*, the composition of which occupied him for more than seven years. It was in 1758 that this book, which was to be the rival of *L'Esprit des Lois*, appeared. It was so far successful at the very outset as to attract immediate attention and to arouse the most formidable opposition, at the head of which was the dauphin, son of Louis XV. The Sorbonne condemned the book; the priests persuaded the court that it was full of the most dangerous doctrines, and the author, ter-

rified at the storm he had raised, wrote three separate retractions; yet, in spite of his protestations of orthodoxy, he had to give up his office at the court, and the book was publicly burned by the hangman. The virulence of the attacks upon the work, as much as its intrinsic merit, caused the whole world to read it; it was translated into almost all the languages of Europe; it was discussed in every literary circle. Yet the *Esprit des Lois* lives, and is still studied with profit, while *De l'Esprit* has long since been forgotten. Helvetius died in 1771.

HELVIDIUS PRISCUS lived in the first century, during the reigns of Nero, Galba, Otho, Vitellius and Vespasian. During Nero's reign he was quæstor in the province of Achaia; he was also sent into Armenia in command of a legion, and by his good sense and moderation he succeeded in restoring peace and order in that country. By the provincials he was respected and trusted. His well-known sympathies with such men as Brutus and Cassius occasioned his banishment in 66 A.D., and he lived with his wife, Fannia, in Macedonia, until Nero's death. Having been recalled to Rome by Galba in 68 A.D., he at once impeached Eprius Marcellus, one of the most villainous of the informers, and the very man who had been the accuser of Thræsea Pætus. He was banished, his wife Fannia, whose constancy and virtue are highly commended by his friend, the younger Pliny, going with him into exile. Shortly afterward he was executed by Vespasian's order.

HELVOETSLUYS (in Dutch, *Hellevoëtshuis*), a fortified town of the Netherlands, in the province of South Holland, situated in the south of the island of Voorne-and-Putten, on the shore of the Haringvliet. Population, 5,000.

Helvoetsluys was founded in the seventeenth century. The construction of the dock was decreed by the states of Holland in 1636, and the erection of the fortifications in 1638; but it was not till 1696 that the works were completed. The new harbor soon became an important rendezvous for the Dutch fleet, and in 1688 it was the starting-point of William of Orange's expedition to England.

HELYOT, PIERRE, monastic historian, was born at Paris in January, 1660, and died in 1716.

HEMANS, FELICIA DOROTHEA, was born in Liverpool, September 25, 1793. Felicia, the fifth of seven children, grew up in the wildest seclusion, in a romantic old house by the seashore, and in the very midst of the mountains and myths of Wales. The little Felicia was a lovely, precocious child. Her education was desultory; and she may indeed be said to have educated herself, the only subjects in which she ever received regular instruction having been French, English grammar, and the rudiments of Latin. Books of chronicle and romance, and every kind of poetry she read with avidity; and she studied Italian, Spanish, French, and German sufficiently to be able to read them with ease and enjoyment. In 1808, when she was only fourteen, a quarto volume of her *Juvenile Poems* was published by subscription. The verses having been rather harshly criticised in the *Monthly Review*, the little poetess was for some days in tears; but the muse was soon reawakened. One of her brothers was fighting in Spain under Sir John Moore; and Felicia, fired with military enthusiasm, wrote *England and Spain, or Valour and Patriotism*, which was afterward published and translated into Spanish. Her second volume, entitled *The Domestic Affections and other Poems*, appeared in 1812, on the eve of her marriage to Captain Hemans, which took place in the summer of that year. Her poem entitled *The Restoration of Works of Art to Italy* was published in 1816, her *Modern Greece* in 1817, and in the

following year appeared her volume of *Translations from Camoens and other Poets*.

In 1818 Captain Hemans went to Rome, leaving his wife, shortly before the birth of their fifth child, with her mother at Bronwylfa. No further explanation than that it was in the first instance for Captain Hemans' health has ever been offered of this step; there seems to have been then merely a tacit agreement, perhaps on account of their limited means, that they should live for a time apart. Letters were interchanged, and Captain Hemans was often consulted about his children; but the husband and wife remained separate, and indeed never met again. For the next six years her literary industry never flagged. In 1819 she published *Tales and Historic Scenes in Verse*, and in the same year she gained a prize of £50 offered for the best poem on *The Meeting of Wallace and Bruce on the Bank of the Carron*. The poem was published in *Blackwood's Magazine*. In 1820 appeared *The Sceptic* and *Stanzas to the Memory of the late King*. In June she won the prize awarded by the Royal Society of Literature for the best poem on the subject of *Dartmoor*, and during the same year she began her play, *The Vespers of Palermo*. She now applied herself to a course of German reading. Körner was her favorite German poet, and her lines on the grave of Körner were one of the first English tributes to the genius of the young soldier-poet. *The Voice of Spring*, one of her best known lyrics, was written in 1823, the same year in which she began to contribute to the *New Monthly Magazine*; and in the summer of 1823 a volume of her poems was published by Murray, containing *The Siege of Valencia*, *The Last Constantine*, and *Belshazzar's Feast*, which last had appeared previously in a collection edited for a charitable purpose by Joanna Baillie. *The Vespers of Palermo* was acted at Covent Garden, December 12, 1823. The play was a failure, and was withdrawn after the first performance. It was acted again in Edinburgh in the following April with greater success. In the same year she wrote *De Chatillon, or the Crusaders*. In 1824 she began *The Forest Sanctuary*, which appeared a year later with the *Lays of Many Lands*, and miscellaneous pieces collected from the *New Monthly Magazine* and other periodicals.

In the spring of 1825 Mrs. Hemans, with her mother and children and an unmarried sister, removed from Bronwylfa, which had been purchased by her brother, to Rhyllon, another house belonging to him on an opposite height across the river Clwyd. The contrast between the two houses suggested her *Dramatic Scene between Bronwylfa and Rhyllon*. The house itself was bare and unpicturesque, but the beauty of its surroundings has been celebrated in *The Hour of Romance*, *To the River Clwyd in North Wales*, *Our Lady's Well*, and *To a Distant Scene*. Her popularity was spreading, not only in England but in America, where Professor Norton of Harvard university undertook to superintend the publication of a complete edition of her works and to secure to her the profits. Her own health began to alarm her; and though the nature of her illness, which afterward proved heart complaint, was not at first apparent, she was from this time an acknowledged invalid. Her poetry of this date is chiefly religious. Early in 1834 her *Hymns for Childhood*, which had appeared some years before in America, were published in Dublin. At the same time appeared her collection of *National Lyrics*, and shortly afterward *Scenes and Hymns of Life*. She was planning also a series of German studies, to consist of translations from German authors, with introductions and explanatory notes, one of which, on Goethe's *Tasso*, was completed and published in the *New Monthly Magazine* for January, 1834. In intervals of acute suffering she wrote the

lyric *Despondency and Aspiration*, and dictated a series of sonnets called *Thoughts during Sickness*, the last of which, *Recovery*, was written when she fancied she was getting well. Her last poem, the *Sabbath Sonnet*, was dictated to her brother on Sunday, April 26th; she died on the evening of Saturday, May 16, 1835, at the age of forty-one. Many of her poems, such as *The Treasures of the Deep*, *The Better Land*, *The Homes of England*, *Casabianca*, *The Palm Tree*, *The Graves of a Household*, *The Wreck*, *The Dying Improvisatore*, and *The Lost Pleiad*, have become standard English lyrics, and on the strength of these, and others such as these, Felicia Hemans is ranked among the chief British lyrical poets.

HEMEL-HEMPSTEAD, a market-town of England, county of Hertford, twenty-three miles northwest of London. Population, 9,000.

HEMEROBAPTISTS, an ancient Jewish sect, so named from their observing a practice of daily ablution as an essential part of religion. Epiphanius, who mentions their doctrine as the fourth heresy among the Jews, classes the Hemerobaptists doctrinally with the Pharisees, from whom they differed only in, like the Sadducees, denying the resurrection of the dead.

HEMINGFORD, or HEMMINGFORD, WALTER, a Latin chronicler of the fourteenth century, was a canon regular of the Austin Priory of Gisborough, now Guisborough, in Yorkshire.

HEMIPTERA, an order of the *Insecta* most commonly known by the name of "bugs," and containing the species so well known to infest houses. In their earlier stages they have what is known among naturalists as an incomplete metamorphosis; that is to say, after quitting the egg, and during the two stages of their existence before assuming the perfect form, they move freely about, thus unlike the *Lepidoptera*, etc., whose pupa state, or that preceding the perfection of the insect, is quiescent. When the transformations have been completed, the insect generally possesses four wings. The superior pair, or hemielytra as they are called by authors, are attached to the mesothorax, and are composed of two substances—the basal portion coriaceous, or resembling leather, and the apical one membranous, or resembling thin, transparent parchment. The lower pair are attached to the metathorax, and are entirely membranous and generally transparent, and capable of being folded when the insect is in repose. This segment of the sternum likewise bears on each side, anteriorly, a more or less reniform-shaped orifice, within which lies a sac containing the fluid or matter from which so many of the *Heteropterous* portion of the order emit a most disagreeable odor. They also possess in all stages a mouth (rostrum) composed of three or more joints formed for suctorial purposes.

The whole of the group is extremely widely distributed, being found in almost every portion of the globe; and they are very varied both in form and in their modes of life—man, animals, birds, insects, and plants being subjected to their attacks. On the Continent they have for a long period engaged the attention of naturalists, but in England little was known of the actual number inhabiting these islands until Douglas and Scott in 1865 published their volume of *British Hemiptera-Heteroptera*. In 1859 Dr. A. Dohrn published what may be considered to be the first whole-world catalogue of the order; and, taking it as a basis, for there is no other approximate list, and adding a reasonable amount of new species collected in each year since that time, their number would amount to nearly 10,500 species, 5,300 belonging to the heteropterous section and the remainder to the second sub-order. Out of these Europe lays claim to at least 3,000, while Great Britain is known to possess not

fewer than 1,000. There is no record of any one of the species being cosmopolitan (except perhaps the house bug, *Acanthia lectularia*), although some of the species inhabiting England are also to be met with in China and Japan.

HEMLING. See MEMLING.

HEMLOCK is the *Conium maculatum* of botanists, a biennial umbelliferous plant, found wild in many parts of Great Britain and Ireland, where it occurs in waste places, on hedge-banks, and by the borders of fields, and which is also widely spread over Europe and temperate Asia, and naturalized in the cultivated districts of North and South America. It is an erect branching plant, growing from three to six feet high, and emitting a disagreeable smell, like that of mice. The stems are hollow, smooth, somewhat glaucous, green, spotted with dull dark purple, as alluded to in the specific name, *maculatum*. The root-leaves have long furrowed footstalks, sheathing the stem at the base, and are large, triangular in outline, and repeatedly divided or compound, the ultimate and very numerous segments being small, ovate, and deeply incised at the edge. These leaves generally perish after the growth of the flowering stem, which takes place in the second year, while the leaves produced on the stem become gradually smaller upward. The branches are all terminated by compound many-rayed umbels of small white flowers, the general involucre consisting of several, the partial ones of about three short lanceolate bracts, the latter being usually turned toward the outside of the umbel. The flowers are succeeded by broadly ovate fruits, the mericarps (half-fruits) having five ribs which, when mature, are waved or crenated; there are no vittæ or oil-cysts; and when cut across the albumen is seen to be deeply furrowed on the inner face, so as to exhibit in section a reniform outline. The fruits when triturated with a solution of caustic potash evolve a most unpleasant odor.

Hemlock is a virulent poison, but it varies much in potency according to the conditions under which it has grown, and the season or stage of growth at which it is gathered. In the first year the leaves have little power, nor in the second are their properties developed until the flowering period, at which time, or later on when the fruits are fully grown, the plant should be gathered. The wild plant growing in exposed situations is to be preferred to garden-grown samples, and is more potent in dry warm summers than in those which are dull and moist.

The poisonous property of hemlock resides chiefly in the alkaloid *conine* or *conia* which is found in both the fruits and the leaves, though in exceedingly small proportions in the latter. Conine resembles nicotine in its deleterious action, but is much less powerful. No chemical antidote for it is known.

The fruits are the chief source whence conine is prepared. The principal forms in which hemlock is employed are the extract and juice of hemlock, hemlock poultice, and the tincture of hemlock fruits. Large doses produce vertigo, nausea, and paralysis; but in smaller quantities, administered by skillful hands, it has a sedative action on the nerves. It has also some reputation as an alterative and resolvent, and as an anodyne.

HEMP, *Cannabis sativa*, an annual herb, having angular rough stems and alternate lobed leaves. The bast fibers of *Cannabis* are the hemp of commerce, but under the name of hemp fibrous products from many different plants are often included. Manila hemp or feather fiber is derived from the fibro-vascular bundles of certain monocotyledons.

The hemp-plant, like the hop, which is the other mem-

ber of the same natural order, *Cannabinaceæ*, is dioecious, that is, the male and female flowers are borne on separate plants. The male plant is smaller than the female, and ripens and dies earlier in the summer. The foliage of the female plant is much darker and more luxuriant than that of the male. The leaves of hemp are constituted of five to seven leaflets, the form of which is lanceolate-acuminate, and sharply serrate. The loose panicles of male flowers and the short spikes of female flowers arise from the axils of the upper leaves. The height of the plant varies greatly with season, soil, and manuring: a variety (*C. sativa*; var. *gigantea*) has produced specimens over seventeen feet in height, but the average height of the common sort is about eight to ten feet. The original country of the hemp plant was doubtless in some parts of temperate Asia, probably near the Caspian Sea. It spread westward through Europe, and southward through the Indian peninsula. Wild hemp still grows on the banks of the Lower Ural and the Volga, near the Caspian Sea. It extends to Persia, the Altai range, and northern and western China. It is found in Kashmir, and on the Himalaya, growing vigorously as far up as 6,000 or even 10,000 feet.

Hemp is grown for three products—the fiber of its stem; the resinous secretion which is developed in hot countries upon its leaves and flowering heads; its oily seeds.

Hemp has been employed for its fiber from ancient times. Herodotus mentions the wild and cultivated hemp of Scythia, and describes the hempen garments made by the Thracians as equal to linen in fineness. Hesychius says the Thracian women made sheets of hemp. Moschion (about 200 B.C.) records the use of hempen ropes for rigging the ship *Syracusia* built for Hiero II. The hemp plant has been cultivated in northern India from a considerable antiquity, not only as a drug but for its fiber. The Anglo-Saxons were well acquainted with the mode of preparing hemp. Hempen cloth became common in central and southern Europe in the thirteenth century.

The medicinal and intoxicating properties of hemp have probably been known in Oriental countries from a very early period.

The hemp-plant grown in some parts of the United States yields the active resin so freely that less than one grain of the extract is a full dose. But it is as a fiber-producer that the hemp is now being more extensively cultivated in the United States. Hemp seeds were ordered for Plymouth colony as early as 1629, but the greater profit derivable from tobacco has always opposed the development of hemp-growing. The plant is chiefly grown in the States of Kentucky, Missouri, Tennessee, Ohio, Indiana and New York. The produce per acre in the United States is from 700 to 1,000 pounds of fiber, four to six pecks of seed being usually sown.

Although the hemp-plant is grown in India chiefly for the production of its narcotic or intoxicating resin, yet a good deal of true hemp fiber is produced there. It is imported into England, however, chiefly from Russia, the United States, Italy, Holland, Germany, Hungary and Turkey. It is grown in Ireland, and in some parts of England. It thrives well in Algeria. It requires a rich deep soil and heavy manuring, and is an exhausting crop. The male plants are pulled from the end of July to the end of August, the female or seed-bearing plants being gathered in September.

Hemp, as a drug or intoxicant for smoking and chewing, occurs in the three forms of bhang, ganja and charas.

Bhang, the Hindustani *siddhi* or *sabzi*, consists of the dried leaves and small stalks of the hemp; a few fruits occur in it. It is of a dark brownish-green color,

and has a faint peculiar odor, and but a slight taste. It is smoked with or without tobacco; or it is made into a sweetmeat, with honey, sugar and aromatic spices; or it is powdered and infused in cold water, yielding a turbid drink, *suûdschi*. *Hashish* is one of the Arabic names given to the Syrian and Turkish preparations of the resinous hemp leaves. One of the commonest of these preparations is made by heating the bhang with water and butter, the butter becoming thus charged with the resinous and active substances of the plant.

Ganja, the guaza of the London brokers, consists of the flowering and fruiting heads of the female plant. It is brownish-green, and otherwise resembles bhang, as in odor and taste.

Charas, or *churrus*, is the resin itself collected, as it exudes naturally from the plant, in different ways. The best sort is gathered by the hand like opium; sometimes the resinous exudation of the plant is made to stick first of all to cloth, or to the leather garments of men or even to their skin, and is then removed by scraping, and afterward consolidated by kneading, pressing and rolling. It contains about one-third or one-fourth its weight of the resin.

Hemp, however consumed, acts in a most strange way upon the nervous system, but its effects differ greatly with races as well as with individuals. Generally the first effect of a small dose is to produce increase of appetite and cheerfulness. Larger doses produce hallucinations, delirium, sleep, and sometimes catalepsy. During the dreamy state induced by an average dose of hashish, the patient becomes the sport of rapidly shifting ideas. Errors of perception as to time and place are a conspicuous characteristic of its effects on the mind. Extract of hemp has been repeatedly tried in modern European medical practice without very consistent or satisfactory results. It has antispasmodic and anodyne characters, and has been employed in tetanus, spasmodic cough, hydrophobia, and some forms of mania. It is a quietener of the nervous system, but does not cause constipation, check the appetite, nor diminish the secretions like opium.

Hemp is largely used in Eastern countries as an intoxicant and narcotic—probably by nearly 300,000,000 of the human race. The amount consumed cannot be estimated.

The ripe seeds, really fruits, being nuts or achenes of the hemp plant, contain about 34 per cent. of oil and 16 of albuminoids. When the crushed seeds have been submitted to pressure, the residual cake is found to contain about 7 per cent. of oil. The value of hemp cake as a cattle-food is lessened by its purgative property. The seeds are much used as a food for singing birds. A hundred parts of the seed yield from seventy to seventy-five of cake and twenty-five to thirty of oil. This oil has drying properties, though it is in this respect much inferior to linseed oil. Its specific gravity is .9307. The seeds are roundish ovate, about one-eighth inch in length, and of a dark gray color, with a pale ash-colored network of surface markings.

HEMS, HOMS, or HUMS, a town of Syria, about sixty-three miles by road northeast of Tripoli (Tarâbulus) situated 1,312 feet, according to Cernik, above the level of the sea, on the eastern side of the valley of the Nahr el Asy or Orontes, which about four miles further down forms the lake of Hems, Atini, or Kabas. The population is estimated at from 20,000 to 40,000, and about 7,000 are Christians.

HEMSTERHUIS, FRANÇOIS (1720-1790), writer on æsthetics and moral philosophy, was born at Franeker in Holland.

HEMSTERHUIS, TIBERIUS (1685-1766), philologist and critic, was born at Groningen in Holland.

HÉNAULT, CHARLES JEAN FRANÇOIS (1685-1770), French historian, was born in Paris. The literary work on which Hénault bestowed his chief attention was the *Abrégé Chronologique*, first published in 1744 without the author's name. It is a model of its kind, and is valuable both for popular use and as a work of reference. In the compass of two volumes he has comprised the whole history of France from the earliest times to the death of Louis XIV. His information is for the most part drawn from original sources, and for such a work the number of errors committed by Hénault was remarkably small.

HENBANE is the common name of the *Hyoscyamus niger*, a Solanaceous plant indigenous to Britain, found wild in waste places, and cultivated for medical use. It occurs also in central and southern Europe and in western Asia, and has long been naturalized in the United States. There are two forms of the plant, an annual and biennial, which spring indifferently from the same crop of seed. Both the leaves and the seeds are employed in pharmacy. In small and repeated doses henbane has been found to have a tranquillizing effect upon persons affected by severe nervous irritability. In poisonous doses it causes loss of speech, distortion, and paralysis. In the form of extract or tincture it is a valuable remedy in the hands of a medical man, either as an anodyne, a hypnotic, or a sedative. The extract of henbane is rich in nitrate of potassium and other inorganic salts. The smoking of the seeds and capsules of henbane is noted in books as a somewhat dangerous remedy adopted by country people for toothache. Accidental poisoning from henbane occasionally occurs.

HENDERSON, the county seat of a county of the same name in the northwestern part of Kentucky, lies on the Ohio river, ten miles south of Evansville, Ind. It is the seat of a large trade, both by the river and several lines of railway, but is especially noted as the center of a rich tobacco-growing country, there being over a score of factories and warehouses in the city devoted to this industry. Henderson also possesses railway shops, flour and saw mills, and manufactories of farming implements. The surrounding country is richly supplied with hardwood timber and coal. In 1890 Henderson's population was 8,835.

HENDERSON, ALEXANDER, a celebrated Scottish ecclesiastic, was born in 1583. He was educated at the University of St. Andrews, where he was appointed professor of rhetoric and philosophy and questor of the faculty of arts in 1610. A year or two after this he was presented to the living of Leuchars by Archbishop Gladstones. As Henderson was forced upon his parish by an archbishop, and as he was known to sympathize with Episcopacy, his settlement was at first extremely unpopular; but he subsequently changed his views, and became a Presbyterian in doctrine and church government, and one of the most esteemed ministers in Scotland. On March 1, 1638, the public signing of the "National Covenant" began in Greyfriars Church, Edinburgh. Henderson is mainly responsible for this document; and he seems always to have been applied to when any manifesto of unusual ability was required. Henderson's next public appearance was in the famous Assembly which met in Glasgow on November 21, 1638. In 1640 Henderson was elected by the town council rector of Edinburgh university—an office to which he was annually reelected till his death. In 1643 the "Solemn League and Covenant," after undergoing some slight alterations, passed the two Houses of Parliament and the Westminster Assembly, and thus became law for the two kingdoms. By means of it Henderson has had an extraordinary influence on the history of Great Britain. As Scottish commissioner

to the Westminster Assembly, he was in England from August, 1643, till August, 1646; and he died August 19, 1646.

HENDERSON, EBENEZER, Scottish dissenting minister, and theological and miscellaneous writer, was born at the Linn near Dunfermline, November 17, 1784, and died at Mortlake, May 17, 1858.

HENGSTENBERG, ERNST WILHELM (1802-1869), for more than forty years one of the most conspicuous and able champions of the strictest Lutheran orthodoxy, was born at Fröndenberg, a Westphalian village near Hamm, and not far from the Ruhr.

HENKE, HEINRICH PHILIPP KONRAD (1752-1809), a learned German theologian of the broad school, best known as a writer on church history, was born at Hehlen, Brunswick, on July 3, 1752, was educated at the gymnasium of Brunswick and the university of Helmstädt, and from 1778 until his death, which occurred on May 2, 1809, held a professorship of theology in that university.

HENLEY, JOHN, an eccentric clergyman of the last century, commonly known as "Orator Henley," was born August 3, 1692, at Melton-Mowbray, England, and died in 1759.

HENLEY-ON-THAMES, a market town of Oxfordshire, England, is situated on the left bank of the Thames and at the terminus of a branch of the Great Western Railway. Henley is a favorite summer resort, and also possesses some trade in corn, flour, malt and timber. It is celebrated for the Henley Royal Regatta, the principal gathering of amateur oarsmen in England, which usually takes place in July. The population of the parish is 4,000.

Henley existed at a very early period, and according to some authorities was a Roman station. It obtained a charter of incorporation from Elizabeth, in which it is named *Hanleygang* or *Hanneburg*. In 1643 it was occupied by the Parliamentary forces, who successfully repelled an attack made upon them by the Royalists.

HENNA is the Persian name for a small shrub found in the East Indies, Persia, the Levant, and along the African coast of the Mediterranean, where it is frequently cultivated. It forms a slender shrubby plant of from eight to ten feet high, furnished with opposite oval-lanceshaped smooth leaves, which are entire at the margins, and bears small white four-petaled sweet-scented flowers disposed in panicles. The four spreading petals are obovate, and furnished with claws; and alternating with them are eight stamens approximating by pairs.

Henna or Henné is of ancient repute as a cosmetic. This consists of the leaves of the *Lawsonia* powdered and made up into a paste; this is employed by the Egyptian women; and also by the Mahomedan women in India, to dye their finger nails and other parts of their hands and feet of an orange red color, which is considered to add to their beauty. The color lasts for three or four weeks, when it requires to be renewed. Henna is also said to have been held in repute among the Hebrews, being considered to be the plant referred to as camphire in the Bible.

HENNEBONT, a town of France, arrondissement of Lorient, and department of Morbihan, is situated on the Blavet, not far from its mouth, and twenty-five miles west-northwest of Vannes. Population (1890), 5,000.

HENNEQUIN, PHILIPPE AUGUSTE, French painter, was a pupil of David. He was born at Lyons in 1763, distinguished himself early by winning the "grand prix," and left France for Italy. The disturbances at Rome during the course of the Revolution obliged him to return to Paris, where he executed the *Federation of July*

14th. In July, 1794, he was accused before the revolutionary tribunal and thrown into prison. Hennequin escaped, only to be anew accused and imprisoned in Paris, and after running great danger of death, seems to have devoted himself thenceforth wholly to his profession. At Paris he finished the picture ordered for the municipality of Lyons, and in 1801 produced his chief work, *Orestes Pursued by the Furies*. He was one of the four painters who competed when in 1802 Gros carried off the official prize for a picture of the *Battle of Nazareth*, and in 1808 Napoleon himself ordered Hennequin to illustrate a series of scenes from his German campaigns, and commanded that his picture of the *Death of General Salomon* should be engraved. After 1815 Hennequin retired to Liège, and there, aided by subventions from the government, carried out a large historical picture of the *Death of the Three Hundred in Defense of Liège*—a sketch of which he himself engraved. In 1824 Hennequin settled at Tournay, and became director of the academy; he exhibited various works at Lille in the following year, and continued to produce actively up to the day of his death, which took place in May, 1833.

HENNERSDORF, or SEIFHENNERSDORF, a manufacturing village of Saxony, in the circle of Bautzen, and twenty miles south-southeast of the town of that name. Population, 7,000.

HENRIETTA MARIA, queen of Charles I. of England, born November 25, 1609, was the daughter of Henry IV. of France. When the first overtures for her hand were made on behalf of Charles, prince of Wales, in the spring of 1624, she was little more than fourteen years of age. Her brother, Louis XIII., only consented to the marriage on the condition that the English Roman Catholics were relieved from the operation of the penal laws. When therefore she set out for her new home in June, 1625, she had already pledged the husband to whom she had been married by proxy on May 1st to a course of action which was certain to bring unpopularity on him as well as upon herself.

When the Scottish troubles broke out, she raised money from her fellow Catholics to support the king's army on the borders in 1639. During the session of the Short Parliament in the spring of 1640, the queen urged the king to oppose himself to the House of Commons in defense of the Catholics. When the Long Parliament met, the Catholics were believed to be the authors and agents of every arbitrary scheme which was supposed to have entered into the plans of Strafford or Laud. Before the Long Parliament had sat for two months, the queen was urging upon the pope the duty of lending money to enable her to restore her husband's authority. She threw herself heart and soul into the schemes for rescuing Strafford and coercing the parliament. The army plot, the scheme for using Scotland against England, and the attempt upon the five members were the fruits of her political activity.

In the next year the queen effected her passage to the Continent. In February, 1643, she landed at Burlington Quay, placed herself at the head of a force of loyalists, and marched through England to join the king near Oxford. After little more than a year's residence there, on April 3, 1644, she left her husband to see his face no more. At Exeter she gave birth to her youngest child, who was one day to be duchess of Orleans, and to negotiate the treaty of Dover. Henrietta Maria found a refuge in France. Richelieu was dead, and Anne of Austria was compassionate. As long as her husband was alive the queen never ceased to encourage him to resistance.

When after the Restoration she returned to England, she found that she had no place in the new world.

She received from parliament a grant of £30,000 a year in compensation for the loss of her dower-lands, and the king added a similar sum as a pension from himself. In January, 1661, she returned to France to be present at the marriage of her daughter Henrietta to the duke of Orleans. She died on August 31, 1666, at Colombe, not far from Paris.

HENRY I., king of England, fourth and youngest son of William the Conqueror and Matilda of Flanders, was born in 1068. Local tradition fixes his birthplace at Selby in Yorkshire. Condemned, by the division of the Conqueror's territories, to a position of inferiority to his two brothers, he used his legacy to improve that position. Nevertheless, in the treaty between William and Robert made in 1091, he was excluded from the succession, and soon afterward was deprived of his lands in Normandy.

The treatment he met with from Robert was not likely to make him support the terms of the treaty of 1091. Immediately after the death of Rufus, he rode to Winchester, and seized the royal hoard in that city. Next day (August 3, 1100) he was elected king by such of the witan as were present, and on Sunday, August 5th, he was crowned at Westminster. Before the year was out he married Matilda, daughter of Malcolm and Margaret, and great-granddaughter of Edmund Ironside, a step which greatly strengthened his otherwise insecure title to the crown. The alliance thus contracted with the church and the nation was his constant support in the struggle with his brother and his unruly vassals, which began immediately. It resulted in the conquest of Normandy, the temporary suppression of feudalism, and the consolidation of royal power on both sides of the Channel. Robert, as soon as he returned from the Holy Land, attempted with the aid of a conspiracy in England to wrest the crown from the usurper. He landed at Portsmouth (August 1, 1101), but before a blow was struck the brothers came to terms. Robert recognized Henry as king of England, and returned to Normandy. Secure in England, Henry carried the war into the enemy's country. His brother's misgovernment gave him both pretext and opportunity. After two or three expeditions, the struggle was brought to a close by the battle of Tenchebrai (September 28, 1106), in which Robert was taken prisoner. He remained in captivity till his death in 1134, and Normandy passed into the possession of the English king. This conquest at once brought Henry into collision with France. A war with France (1111-1113) ended in a peace which brought some advantages to Henry. Louis gave up his claim to the sovereignty of Maine and Brittany, and Henry was able to carry his old opponent, Robert of Belesme, to England, where he was imprisoned for the rest of his life. Henry had already, though in vain, attempted to secure the aid of Flanders by two treaties with Count Robert (1103, 1108). He now sought a mightier ally in the emperor Henry V., to whom he married his daughter Matilda (January 7, 1114). Another war with France, which broke out in 1116, and in which Louis took up the cause of William, son of Robert, against his uncle, was marked by the battle of Noyon (1119). At a council at Rheims (1119) Louis accused Henry before Pope Calixtus of rebellion and usurpation. Henry, however, pleaded his own cause before the pope at Gisors so persuasively that Calixtus brought about a peace between the two kings (1120) on the basis of a mutual restoration of conquests. During the war Henry had suffered a severe loss in the death of his queen Matilda. He now felt it more than ever necessary to take measures for securing the succession to his only son William, who married Matilda, daughter of Fulk of Anjou, an alliance by which Henry hoped to turn a

dangerous foe into a firm friend, and to secure at least the chance of a rich inheritance. All these hopes were, however, shattered by the death of William (1120). Deprived of an heir to his throne, Henry now married Adeliza, daughter of Godfrey, count of Louvain (1121), but the marriage proved childless. Shortly afterward another rebellion, headed by Count Walern of Meulan, broke out in Normandy (1123). The terrible vengeance taken by Henry, together with the death of William, son of Robert, in 1128, seems to have finally crushed the opposition in Normandy. The death of Duke Robert in 1134 removed the last object round which the schemes of rebellion or the intrigues of France could center. Meanwhile Henry had recalled his daughter Matilda, now a widow, from Germany. In default of an heir to the throne, he made the witan swear to accept her as Lady of England and Normandy (Christmas, 1126). Next year he gave her in marriage to Geoffrey, son of Fulk, count of Anjou, hoping thereby to secure the objects frustrated by the death of his son.

Over Scotland, Ireland and Wales a sort of ecclesiastical supremacy was recognized. On the northern frontier there was peace throughout the reign; on the western there was more disturbance. Henry settled a colony of Flemings in Pembroke (1111), and made two expeditions into Wales (1114, 1121), in one of which he received the submission of several Welsh princes. The profound peace which England enjoyed for a period of thirty-four years is the best testimony to Henry's merits as a king. As a man his character is not admirable, nor yet wholly to be condemned. He was hard, merciless, and unforgiving, but not wantonly cruel. Regarded as the "Lion of Justice" by his people, and bitterly regretted after he was gone, he was not a popular king. He died, after bequeathing his crown to his daughter Matilda, near Rouen (December 1, 1135). His body was carried to England and buried in the abbey he had founded at Reading.

HENRY II., king of England, son of Geoffrey, count of Anjou, and Matilda, daughter of Henry I., was born at Le Mans, March 5, 1133. He was left in France during the first part of his mother's struggle with Stephen, but was sent over to England in 1141. On his return to Normandy (1151), Louis VII. conferred the duchy upon him, and later in the year he became, by his father's death, count of Anjou. In 1152 he married Eleanor of Aquitaine, and added Poitou and Guienne to his dominions. He again went to England in 1153, and the great position he had won on the Continent turned the scale in his favor. After a short struggle Stephen consented to negotiate. By the treaty of Winchester (November 7, 1153) it was settled, among other things, that Stephen should reign undisturbed during the rest of his life, and that Henry should succeed him. A year later Stephen died, and Henry took quiet possession of the throne. He was crowned on December 19, 1154, and at once issued a charter of liberties, in which he confirmed the charter of Henry I.

His reign falls into three main periods. During the first Henry was occupied in restoring and maintaining order. The second is that of the quarrel with Becket. The third is for the most part a period of rebellion and trouble, the consequences of that quarrel. In 1156 Henry was able to go to France, where his brother Geoffrey was causing trouble by his claim to Anjou. He had to subdue him by force of arms, after which he allowed him to be chosen count of Nantes. He then exacted homage from his Continental vassals, and himself did homage to Louis VII. An unsuccessful expedition to Wales followed. In 1158, on his brother Geoffrey's death, Henry secured his inheritance. At the same time he betrothed his second son Henry (the eld-

est, William, being dead) to Margaret, daughter of Louis. Next year he made an attack upon Toulouse, which he claimed in right of his wife, but after some successes retired, owing to the opposition of the French king. In a peace made soon after, he retained Cahors, but gave up his claim to the rest of the county. Hostilities between him and Louis were, however, more or less continuous during this time, in spite of the efforts of Alexander III. In January, 1163, Henry returned to England after five years' absence, and his quarrel with Becket immediately began.

Becket had been consecrated archbishop of Canterbury in June, 1162. He at once resigned his temporal offices, and demanded the restitution of land alienated from his see. At a council at Woodstock he refused to pay the tax of two shillings per hide of land demanded by the king. A little later the struggle was removed to still more dangerous ground. Becket refused his consent to the king's proposal for settling the dispute between the temporal and spiritual courts. Upon this Henry asked him and the bishops whether they would abide by the ancient customs of the realm. So vague a question met with an evasive answer. The bishops would only consent "saving their order." However, at the council of Clarendon (January, 1164) the disputed customs were drawn up in the form of sixteen constitutions, and after considerable hesitation accepted by Becket. He nevertheless got absolution from the pope, who refused to confirm the constitutions. Henry now attacked Becket with a series of charges connected with his chancellorship, the result of which the latter evaded by leaving England. Henry took possession of the see, and expelled Becket's friends and relations. He also obtained possession of Brittany for his son Geoffrey, and betrothed Richard to Alice, daughter of Louis. With the object of securing the succession he had his son Henry crowned by the archbishop of York at Westminster (June, 1170). The young king's wife was not crowned with him. Louis, taking this as an insult, invaded Normandy, and only made peace with Henry on condition that he would restore Becket to favor. A meeting between the king and the archbishop ended in a compromise, and the latter returned to England. His first step was to suspend the archbishop of York and other bishops who had taken part in the coronation of the young king, and Henry, on hearing of this, uttered the angry words that led to Becket's murder. The pope was, however, in too critical a position to quarrel seriously with Henry. Negotiations between them ended in a meeting with the legates at Avranches (1172), in which Henry received absolution, and promised to abolish all the bad customs introduced during his reign. He had employed the interval in making an expedition to Ireland, and appropriating the conquests made by Strongbow a few years before.

The ecclesiastical quarrel seemed to have died away, but its consequences were felt in the great rebellion of 1173. A confederacy was organized by the French king, the count of Flanders, the king of Scotland, and Henry's sons, with the object of placing the young Henry on his father's throne. The first campaign was indecisive, but on the whole favorable to the king. In view of a general attack which was to be made next year, Henry crossed over to England and did penance at Becket's tomb. Fortunately his justiciar, De Lucy, captured the Scotch king at Alnwick, and the rebellion in England was speedily put down. William the Lion was forced to buy his release by doing homage to Henry; the other confederates made peace; and Henry was left stronger than ever. He at once proceeded to secure his position by further legislative enactments, and henceforward he had no trouble in England. But

he was involved in constant difficulties with his sons and with the French king, owing to the mutual jealousies of the former and the intrigues of the latter, to which Henry's partiality for his youngest son John and his refusal to allow the marriage of Richard with Alice gave rise. A war between the brothers in 1183 was brought to an end by the death of the younger Henry in the same year. The feud broke out again in 1184, and continued at intervals, in spite of the death of Geoffrey in 1186, to the end of the reign. At length Henry's apparent intention to name John as his successor forced Richard to ally himself with Philip II., and in the war that followed Henry was beaten at all points. He was forced to make a disgraceful peace, the terms of which, together with the discovery that John was among his enemies, broke his heart. He died at Chinon, July 6, 1189, and was buried at Fontevraud.

HENRY III. (1207-1272), king of England, eldest son of John and Isabella, was born on October 1, 1207, and was just nine years old on his father's death. Ten days after that event he was crowned at Gloucester (October 28, 1216). His long reign falls into four periods—that of the regency, ending with the fall of De Burgh; that of government by favorites, which led to the Mad Parliament; the period of the Barons' War; and the short period between the close of the war and Henry's death. At his accession the whole country was in rebellion, and Louis with his Frenchmen held the east and south.

The bad promise of Henry's youth was amply redeemed in the events of the next twenty-six years. Under the influence of Peter des Roches, foreigners began to flock to the court, and even foreign mercenaries were introduced into England. Richard, earl marshal, who openly rebuked the king for this conduct, was outlawed, but other barons took up his cause, and collisions between them and the king's troops took place. Civil war appeared imminent, when Archbishop Edmund persuaded Henry to dismiss Peter des Roches, and the danger was avoided for the time (1234). But the king's partiality for foreigners was a constant source of discontent. In 1256 he married Eleanor of Provence. In 1238 Henry married his sister Eleanor to Simon de Montfort, an event which nearly produced an outbreak. Resistance already centered in the Great Council, which in 1236 had declined "to change the laws of England," and supported the bishop of Chichester in his refusal to give up the great seal at the king's demand. Henry's personal extravagance caused him much embarrassment, and the extortions of the papal see pressed heavily on the church. In 1242 the barons refused to give the aid demanded by the king for another expedition to Poitou, and when they met again after his return, they joined with the clergy in a general protest against his misgovernment (1244). Henry found means of evading the demand. Hitherto his brother Richard, earl of Cornwall, had been the leader of the opposition, but Simon de Montfort, earl of Leicester, was now becoming the center of constitutional resistance. Two mistakes on the part of Henry brought matters to a crisis. He had conferred the government of Gascony on De Montfort in 1248, and the latter had reduced the province to obedience. But accusations made against him found ready audience with the king, who feared and disliked his brother-in-law. The result was a bitter quarrel (1252), which Henry followed up by superseding De Montfort in his government, and sending his eldest son Edward to take his place. This had the effect of throwing the earl once for all into the arms of the national party.

A parliament which met at Westminster (April, 1258) forced Henry to promise reform, and elected a commit-

tee of twenty-four to act for the king till a complete scheme could be drawn up. On June 11th the assembly, called afterward the Mad Parliament, met at Oxford. A council of fifteen, of whom two-thirds were on the baronial side, was appointed, who, together with twelve representatives of the "community," were to take charge of the government and meet in parliament thrice a year. These reforms, together with certain general enactments, went by the name of the Provisions of Oxford. The king's authority was completely superseded, and the rule of baronial oligarchy established. But beyond this the baronial government did nothing. The nation testified its disappointment, and a quarrel took place between the earls of Leicester and Gloucester, which divided the baronial party. The king took advantage of this state of affairs, and in 1261 obtained absolution from the Provisions at the hands of the pope. He then fortified the Tower, deposed the baronial justiciar, and soon began to rule as before. In this crisis the baronial party made a bid for popular favor by summoning representatives of the counties to a parliament, but the reaction was for the time complete, and Henry had leisure to go to France in order to win over Louis IX. to his side. In 1263 hostilities broke out on the Welsh border, and the barons seized the opportunity to renew their attack on the king. After some months of desultory warfare it was agreed to submit to the arbitration of Louis. That king, in the Mise of Amiens, decided in favor of Henry, and annulled the Provisions. Leicester at once appealed to arms. The battle of Lewes (May 14, 1264) was a complete victory for him, and put the king and his eldest son into his hands. For a time he was master of the country, but the party he headed was not that which had been dominant six years before, and Henry now had many adherents among the greater barons. Nevertheless, for more than a year he and his son remained practically prisoners in the hands of De Montfort. Edward's escape (May, 1265) caused an immediate renewal of the war, and at the battle of Evesham (August 4, 1265) De Montfort was killed, and Henry set free. Two years later the war was practically concluded by the capture of Kenilworth. Henry had little to do with the conduct of the war, and acquiesced in the arrangements made by his son for the pacification of the country. His triumph was, however, complete, and for the rest of his reign the kingdom was at peace. He died on November 16, 1272.

HENRY IV., king of England, only son of John of Gaunt and Blanche, daughter of Henry, duke of Lancaster, was born in 1366. At the age of fifteen he married Mary Bohun, and in 1385 was made earl of Derby. Two years later he was one of the five lords appellant who impeached the earl of Suffolk and others, and took part in the proceedings of the Merciless Parliament. He acquiesced, however, in Richard's return to power, supported the king in his *coup d'état* of 1397, and became duke of Hereford. His quarrel with the duke of Norfolk led to his banishment shortly afterward, and on his father's death Richard denied him the succession to his title and inheritance (1398). Next year he took advantage of Richard's absence in Ireland to reassert his rights. He landed in Yorkshire, took Bristol, and seized Richard (August 19th) near Conway Castle. At a parliament which met on September 30th, he claimed the throne on the ground of his descent from Henry III., the right of conquest, and the necessity of reform. He was accepted by the parliament; Richard was forced to abdicate; and Henry was crowned (October 13, 1399). The last of his three claims gives the explanation of his policy. He had won favor of the church by pledges in favor of orthodoxy; the

circumstances of his accession and difficulties of his government forced him to make concessions to the House of Commons, which raised that body to a position it did not again attain for more than two centuries. The first part of his reign was occupied with the suppression of the revolts, not only of the defeated party, but also of his own discontented adherents. These troubles were complicated by hostile relations with France, Scotland, and Wales. Charles VI. was inclined to take up the cause of his daughter Isabella, wife of Richard II., and on the death of the latter (February, 1400) demanded her and her dowry back. The duke of Albany in Scotland was hostile to Henry, and Owen Glendower raised a national revolt in Wales. The first attempt at insurrection was made by the earls of Richard's party early in 1400, but their plans were discovered, and their forces crushed piecemeal. Most of the leaders fell victims to popular vengeance. A more serious rebellion was that of the Percies (1403), hitherto Henry's staunchest supporters. Hotspur and his father thought themselves ill requited for their services, and made common cause with Glendower and other malcontents. A junction of the northern army with the Welsh was prevented by the battle of Shrewsbury (July 21, 1403), in which Hotspur was killed. Northumberland submitted and was pardoned. But the danger was not over. The north was still in a state of ferment, the war in Wales went on, and a French fleet ravaged the southern coast with impunity. Henry's vigilance and activity were, however, equal to the task. A plot to carry off the young earl of March (January, 1405) was foiled, and a fresh outbreak in the north was crushed. Scrope, archbishop of York, and Mowbray, earl marshal, who led the rebels, were taken and executed. The king had already got into his power the son of the duke of Albany; he now captured James, the heir-apparent to the Scotch crown, as he was on his way to France; and the murder of the duke of Orleans removed his chief enemy in that country. Thus secured from danger abroad, he put down a final rebellion in the north, drove Glendower back into his mountains, and henceforth had no trouble at home (1408). The late crisis had, however, compelled him to make important concessions to the House of Commons. He promised (1407) to act solely by the advice of a council nominated with their approval, and submitted to the appropriation of his revenue and other limitations. Throughout his reign he was hampered by want of money, and the regular exercise by parliament of the right to withhold supplies gave that body great control over his actions. His foreign policy was not energetic. He had enough to do at first to defend his coasts, and though he afterward seized the opportunity afforded by civil war to invade France (1411), his efforts were in general confined to strengthening his dynasty by foreign marriages. In his later years he was a confirmed invalid, and had to intrust much power to his eldest son, with whom he was not always on the best of terms. He died on March 20, 1413, and was buried at Canterbury.

HENRY V., king of England, eldest son of Henry IV. and Mary Bohun, was born August 19, 1387. Early bred to arms, his first military effort was not successful, for at the age of thirteen he commanded an expedition to Wales which was defeated by Glendower. Three years later he was present at the battle of Shrewsbury, and in 1408 he revenged himself on Glendower by driving him back to Snowdon. At the same time his position in the council, at the head of which he appears after 1410, gave him experience in affairs, and proves the confidence already felt in his political ability. The stories of his youthful extravagance and dissoluteness are unfounded, and, as the above facts show, improba-

b/e. Although his father appears to have been jealous of his popularity, he was practically at the head of affairs for some years before the death of Henry IV. Three weeks after that event he was crowned (April 9, 1413), and entered upon his inheritance with the goodwill of all classes of the nation. His persecution of heretics caused a conspiracy, which was discovered and put down with some severity (January, 1414). Sir John Oldcastle, the head of the Lollards, was condemned to be burned, and though he escaped for the time, he was again taken in 1417, and put to death. Henry's orthodoxy brought him into connection with the emperor Sigismund, then engaged in settling the affairs of the church at the council of Constance, and his assistance was very instrumental in the healing of the great schism. But the great work of his life was the conquest of France. It was with this object that he issued a kind of general amnesty on his accession, and appealed to the nation as a whole to support him. War was resolved on by parliament, and Henry laid claim to the French crown. This demand was afterward reduced to one for all the districts which the English kings had ever held in France. Such claims as these, of course, precluded all negotiation, and on August 14, 1415, the English army landed at Havre. Harfleur was taken, but the English losses were so great that Henry resolved to retreat to Calais. On October 25th the French army that opposed his march was cut to pieces at Agincourt. The next two years were spent in preparations for continuing the war. In 1417 Henry again invaded France, took Rouen (1419), and with the assistance of the Burgundian party forced Charles VI. to grant his demands. By the treaty of Troyes (1420), it was arranged that he should marry Catherine, take the government in hand at once, and succeed on Charles' death. This disgraceful treaty had, however, the effect of reviving the national party in France, and during Henry's absence in 1421 the English began to lose ground. He hurried back to France, but before he had time to recover his position, he died at the castle of Vincennes, August 31, 1422.

HENRY VI., king of England, only son of Henry V. and Catherine of France, was born on December 6, 1421, and was therefore only eight months old at his father's death. He can hardly be said ever to have reigned, for his long minority passed into another kind of tutelage, during which the influence of his wife and favorites prepared for civil war. Ten years of anarchy culminated in his dethronement, and ten years more of wandering and imprisonment fill the interval between that event and his death. The chief interest of the first thirty years of his life lies in the decay of English power in France; that of the last twenty is to be found in the civil wars which resulted from the misgovernment of the preceding period. Although the English had lost some ground toward the end of Henry V.'s reign, their position, when the duke of Bedford undertook the task of continuing his brother's work, was very favorable. They held the north and center of France, while Burgundy held the eastern districts. The alliance with Duke Philip was strengthened by a marriage between his sister Anne and the duke of Bedford. The Scotch king, James I., was released from captivity, in order that England might be relieved from danger on that side. Thus strengthened, Bedford was able to apply himself vigorously to the conquest of France, toward which the battle of Verneuil (1424) was an important step. But the English cause had already received its first great blow in the marriage of the duke of Gloucester with Jacqueline of Hainault, which destroyed the good understanding between Burgundy and England. Bedford for the time managed to stave off the quarrel,

and after renewing his union with Burgundy, laid siege to Orleans, the key of southern France. The capture of the town seemed certain, when the appearance of Joan of Arc turned the scale. The relief of Orleans (1429) was followed by other French successes, and by the coronation of Charles VII. at Rheims. The capture of Joan did little for England, for the spirit she had inspired survived her loss, and her death (May, 1431) only nerved the French to fresh efforts. It was in vain that Bedford had Henry crowned at Paris (December 17, 1431). The young king remained in France nearly two years (April, 1430, to February, 1432), but his presence did not turn the tide of French success. On the side of England the supply of men and money was falling short, while on that of France a new type of commanders was coming to the front, who were not inclined to repeat the disastrous blunders of Crécy and Agincourt. Bedford's death (September 14, 1435) finally destroyed all hope of recovery in France. Burgundy at once made peace with Charles VII., and the English commanders who succeeded Bedford were constantly defeated. Paris was retaken; Normandy overrun. Repeated efforts on the part of England led only to further exhaustion. Negotiations for peace led in 1444 to a truce, during which Henry was married (April 22, 1445) to Margaret, daughter of René of Anjou. It was hoped that this marriage, together with the cession of Anjou and Maine, would lead to a permanent peace, and save Normandy and Guienne. But though Anjou and Maine were actually surrendered in 1448, the truce was broken next year, and before the end of 1450 the whole of Normandy was lost. In 1451 Guienne was reconquered by the French, and in 1453 Calais alone remained to England. The war was practically at an end.

Its conclusion coincides with the period when the two parties that divided England were just about to appeal to arms. The civil war was in great measure the result of the defeats abroad, as those defeats themselves were in part the consequence of discord at home. The coronation of the young king at Westminster (November 6, 1429) put a formal end to the regency of Bedford and Gloucester, but not to the intrigues of the latter. The House of Commons was unable to interfere with any effect; the Lords were mostly engaged on one side or the other. The death of Bedford removed the only guarantee of peace, and Gloucester attacked Beaufort with more virulence than ever after his brother's death. In the midst of these troubles Henry VI. came of age (1442.)

The work of government was left mainly in the hands of Cardinal Beaufort and the earl of Suffolk, who did their best to secure peace with France. On the other side the dukes of Gloucester and York headed the opposition, and took up the cry of reform, with the object of infusing vigor into the government at home and abroad. Suffolk, however, won a great victory in the truce with France (1444); and through the young queen Margaret, whose marriage was chiefly due to his exertions, he obtained complete influence over the king. The suspicious death of Gloucester (1447), followed in six weeks by the death of his rival Beaufort, together with the appointment of York to the governorship of Ireland, left Suffolk master of the situation. But the complete failure of his foreign policy brought about his fall (1450). The king in vain attempted to save him, and by so doing shared his unpopularity, while the partial concessions he made to the demands of the rebels under Jack Cade only postponed the inevitable outbreak. The duke of York now made himself the mouthpiece of popular discontent. When the final loss of France had exhausted the country's patience, and the birth of an heir to the throne had destroyed his hope of the succession, he took advantage of Henry's mental derangement to claim the protector-

ate (1453). It was granted him early next year, but in 1455 the king recovered his senses, and York was deprived of power. Unable to endure this he marched on London, and on May 22, 1455, the Wars of the Roses began in the battle of St. Albans. The effect of the battle was to bring the queen to the front as the leader of the royalists, and to make the quarrel between her and York irreconcilable. During the four years of uneasy quiet which followed the first collision, Henry tried hard to keep the peace. But all his efforts were vain. When the struggle broke out anew, and the Yorkists won the battle of Northampton, he was forced to consent to an arrangement by which his son was excluded from the succession and York recognized as heir to the kingdom (1460). The settlement was of short duration. York himself lost his life at Wakefield, but his son seized the crown and was acknowledged king (March 4, 1461). The battle of Towton brought the struggle to an end for ten years, and the capture of Henry in 1465 seemed to secure Edward IV. on the throne. Five years later a sudden revolution hurled him from it, and restored the wretched prisoner for a while to liberty, but the battle of Barnet destroyed his hopes again. He had time to know that his son had died at Tewkesbury, that his wife was a prisoner, and that his cause was finally lost, before death released him from captivity on May 21, 1471.

HENRY VII. (1456-1509), king of England, was the founder of the Tudor dynasty. On his mother's side Henry belonged to the illegitimate branch of the house of Lancaster, being descended from John of Gaunt and Catherine Swinford, and it was only in the absence of nearer heirs that he was accepted as the representative of that house. On the father's side he was sprung from the marriage of Owen Tudor, a Welsh gentleman, with Catherine, widow of Henry V., and this family name became the name of the line of kings which he founded. On the complete overthrow of the Lancastrians, especially after Richard had won the throne by putting his nephews out of the way, Henry, under the name of the earl of Richmond, appeared as the center of the opposition. He landed at Milford Haven in order to profit by the good will of his kinsmen the Welsh, and marching into Leicestershire defeated Richard at the battle of Bosworth, thus ending the Wars of the Roses (1485). Soon after he married Elizabeth, daughter of Edward IV., and so the White Rose and the Red were united. Henry, however, was not allowed to enjoy the crown in peace. Two pretenders, one after another, led a rising against him. Lambert Simnel, personating the earl of Warwick, son of the duke of Clarence, gathered the Yorkists about him in Ireland; and, landing in Lancashire, advanced as far as Stoke in Staffordshire, where he was defeated and made captive (1487). Next arose Perkin Warbeck, a Fleming, who, pretending to be one of the princes murdered by Richard in the Tower, received much countenance abroad and in Scotland, and had many supporters among the discontented at home. But when he ventured to land in Cornwall, he was captured, and finally executed (1499). These risings troubled the reign of Henry, but did not shake his throne. He ruled with a firm hand; he took care to repress the nobles, already almost exterminated in the civil war, in this case continuing the policy of Edward IV.; he put down the practice of maintenance, by which they kept bodies of retainers ready to support them in battle, and in every way sought to concentrate in the person of the king the whole power of the nation. Henry was a parsimonious and calculating ruler, who avoided war, gained by diplomacy what other sovereigns attempted by force, kept a well-filled treasury, and made two brief

expeditions into France the occasion of amassing additional wealth. His avarice led him even to revive old and forgotten statutes, and to exact heavy fines from those who had transgressed them, in which evil work he was assisted by the two well-known lawyers, Empson and Dudley. His reign is marked also by two marriage arrangements which had great influence on subsequent history. His son Arthur was wedded to Catherine of Aragon. When Arthur died in 1502, a few months after the marriage, Catherine remained in England in order to be united to the younger son, Henry, though the nuptials did not take place till after his accession to the throne. The other marriage was that of the young princess Margaret to James IV. of Scotland (1503), which a century after resulted in the union of the crowns. Henry VII. died in 1509, leaving, it is said, a treasure of two million pounds to his successor.

HENRY VIII., king of England, was born in 1491, being the second son of Henry VII. and of his wife Elizabeth of York. On the death of his elder brother Arthur in 1502, he became heir apparent to the throne. His training under the severe and methodical Henry VII. must have been a very careful one; he was deeply interested in the new learning, and was a most accomplished scholar. During his father's lifetime we hear nothing of the young king except as the destined husband of Catherine of Aragon, the widow of his brother Arthur, a lady six years older than himself. It suited the plans of the old monarchs, their parents, that Catherine should be wedded to Henry, and so she remained in England during the seven years of her widowhood. Henry was only eighteen when the death of his father (1509) left the throne of England vacant, as well as set him free to shape his own career. His first important act was to fulfill the contract imposed upon him by his father to marry Catherine. His ministers, almost without exception, were in favor of the marriage. Henry expressed himself highly delighted with his wife. Catherine was fond of him to excess. The disparity of years was not so marked at that early period; Catherine was amiable, accomplished, of the bluest blood in Europe, closely connected with the most powerful dynasties, a queen of whom England with her then diminished prestige might well be proud. For the time all went well, and no one saw in such a simple event the seeds of a great revolution.

The reign of Henry falls naturally into two periods, separated by the question of the divorce. During the first period Henry is the splendid and jovial king at home; abroad a figure of the first magnitude in the wars and international diplomacies of the time. Both in home and foreign affairs, but particularly the latter, Wolsey was the right hand man of the king, ready, as occasion served, either to transact the whole business of the government, or to be the humble instrument of the king, when the royal hand did actively interfere. In point of fact Henry always was master, and took a keen interest in business. The events of the first period were concerned chiefly with the foreign wars. At home, with the exception of the execution of Empson and Dudley, the instruments of his father's extortion, who suffered however, on a trumped-up charge of treason, nothing important occurred. There were Christmas revels, May festivals, tilting matches, in which Henry always shone victorious, and in which he squandered the treasures of his father. But the serious endeavors of the time were directed abroad; Henry joined his relatives Ferdinand and Maximilian in a league against France. Though Henry took a personal share in the campaign in France of 1513, and won the easy Battle of Spurs, and though Surrey, his general, gained the great victory of Flodden, no substantial result was attained by either war.

Henry was duped and then abandoned by his allies. When he was undeceived, he made peace (1514) with France, which was cemented by the marriage of his youthful sister Mary to the old and worn-out Louis XII. Soon after, when Louis was succeeded by Francis I. (1515), and Charles V. entered on the government of his hereditary dominions (1516), the three monarchs who figure so conspicuously as the contemporaries of the Reformation, and whose doings constitute so much of the history of the sixteenth century, found themselves face to face. With these two and with the successive popes Henry had to do during the rest of his life. Their relations at first were chivalrous and even friendly. Henry never had any chance of success in his canvass for the imperial crown. When it fell to Charles, it made him beyond a doubt the first monarch of the age; his success placed him in open rivalry to Francis; but to Henry, fortunate again, it gave the desirable prospect of being courted by the two rivals, and even of acting as arbiter in their disputes. Henry, however, descended from his lofty position to engage in quarrels which had no concern with the true interests of England. The chimera of French conquest again fascinated him and his people, so that when the false chivalry of the Cloth of Gold had degenerated into war, Henry took the side of Charles. In the campaign of 1523 the English forces advanced to within eleven leagues of Paris, but the war led to no durable and satisfactory result as far as Henry was concerned. The people grew sick of the heavy contributions they were called upon to make, and threatened revolt. After the battle of Pavia (1525), where the French were completely overthrown and their king made prisoner by the armies of Charles, the policy of Henry was completely disturbed. Under these circumstances English policy was forced out of its old groove, and an alliance was made with France. In a short time, moreover, interests and passions of a far more momentous nature emerged. The dilettante politics of Henry's early career were to be superseded by occupations of a tragically earnest nature. Adventurous enterprises abroad were to give place to real interests at home, and the jovial young king was to be transformed into the stern, self-willed, and often cruel revolutionary. The serious and important part of Henry's life therefore is still to come: but before leaving the earlier period it is well to remark that it lasted twenty years, or more than half of his reign; that during these years Henry was popular in the highest degree; and especially that he had gratified the national pride of his subjects by restoring England to a leading position in Europe. This should not be forgotten during the trouble and more questionable events that were to follow.

The year 1528 may justly be fixed as the turning-point of Henry's life. By that time the divorce had become a national and even a European question, and Henry had decisively committed himself to the course which was to result in the separation from Rome. It is not clear when the plan of a divorce began to take shape in Henry's mind; it was the slow result of a variety of causes which were not clear to the king himself. We know, however, that Anne Boleyn returned to the court of England in 1522; that she made quite a sensation there as soon as she appeared; and that among other admirers, married and unmarried, Henry soon expressed a decided preference for her. On the other hand, he seems to have been alienated from Catherine long ere the question of divorce became public; if we may trust a statement of his own, he had abstained from her bed since 1524, and his coldness for her increased with his love for Anne. That his scruples regarding his marriage awoke about the same time was certainly a very convenient coincidence.

When the demand for a divorce was first formally laid before the pope in 1528, no one anticipated that it would encounter so many difficulties. The great opponent of it was Charles V., who loyally supported his aunt, and who, as the event proved, had the pope entirely in his power. But for the emperor, Clement would soon have arranged everything to the satisfaction of the English court. As it was, he sought safety in delay. Thus he declined giving any decisive answer himself, and when he delegated the case to Wolsey and Campeggio, he managed still further to defer the question, and then to revoke it to Rome (1529). By that time Henry's patience was exhausted. As early as 1528, and as if sure of a speedy decision in their favor, the king and Anne were living familiarly together under the same roof. Their disappointment was natural, and Henry soon began to take more active measures. He appealed from the pope to the universities. Notwithstanding his life-long services Wolsey was discarded, because he was supposed not to have been sufficiently earnest about the divorce. The same year (1529) a parliament was called, which proved to be the ready auxiliary of the king in his new policy.

In 1529 the probate duties and mortuaries (or burial fees) exacted by the church were curtailed; the clergy were prohibited from following secular employments; residence was enforced, and pluralities forbidden. In 1531 the clergy were laid under the charge of præmunire, which they bought off by the payment of £118,000, and the acknowledgment that the king was supreme head of the church. In 1532 the abuses of "Benefit of Clergy" were reformed, annates abolished conditionally, and the independent legislative power given up by convocation. Soon after the king took a step which precipitated the crisis; he married Anne Boleyn, an event which was quickly followed by the publication in Flanders of a threat of excommunication from Rome. After this the Act of Appeals was passed, forbidding appeals from the English ecclesiastical courts to Rome, and Cranmer, in a court at Dunstable, declared the marriage with Catherine null and void. In the following year (1534) the papal authority in England was annulled, and by the Act of Supremacy Henry was declared supreme head of the English Church. The next step was a sad one; but it convinced the world that the king was in earnest. Sir Thomas More and Fisher, bishop of Winchester, the noblest champions of the old faith, two of the best and noblest Englishmen of the time, were executed for refusing to accept the Supremacy Act (1535). Such an event produced a deep sensation in Europe, but it was decisive; when the pope drew up the Bull of Deposition in 1536, which, however, was not published till 1538, the rupture with Rome was complete. In the same year (1536) the first Articles of religion, ten in number, were drawn up; in effect they were a great simplification of the old creed, though they gave little encouragement to Lutheranism. At the same time the Act for the dissolution of the smaller monasteries, which was based upon the report of a commission of inquiry, was passed, being the final important measure of the first Reformation parliament. With such events as the abolition of the papal power in England and the dissolution of the monasteries modern England begins; they inaugurate a fundamental change in the national policy and in the structure and habits of society. While the purpose, real or ostensible, of Henry had been merely to marry a younger woman and provide for the succession, he had effected the greatest revolution which England has undergone.

But he had excited the hostility of the pope and the emperor; and had seriously hurt the feelings and prejudices of a large class of his subjects. The danger of

foreign invasion was greatly increased by the discontent both in the north and west of England, where the love of use and wont in the church and in the national habits was strongest. The death of Catherine had indeed greatly relieved him, as it made reconciliation with the emperor practicable, and deprived the English opposition of a common center. The rising in Ireland was suppressed without much difficulty, but the discontent in the north which broke out in the Pilgrimage of Grace was a formidable danger (1536). It was averted more by skillful statemanship on Henry's part than by open show of force. The opposition in the west was nipped in the bud by the execution of its leaders, the marquis of Exeter and Lord Montague (1538). These measures of the king and of his minister Cromwell sometimes appeared cruel and unjustifiable, but they kept the country united; Charles was convinced of the futility of an invasion; and the thunderbolts of the pope fell harmless to the ground.

Henry had defied the emperor and the pope, and he had suppressed the conservative Catholic discontent at home with a high hand; but he was never disposed to be a Protestant. Instead of following the lead of the advanced Reformers he impressed upon the English Church his own moderate and substantially Catholic theology. At thirty he had defended the seven sacraments against Luther; he was thirty-six when he took up the question of divorce, and he was forty ere his relations to the pope had hardened into alienation and hostility. All his life he was orthodox from conviction as well as from traditional assent. Such a man could not be a revolutionary in theology.

In the meantime Henry had been less fortunate in the matrimonial scheme which had been the occasion of all the changes and dangers we have noted. A few months after the death of Catherine, Anne Boleyn was sent to the scaffold. Anne may have been guilty of the crimes laid to her charge, but Henry himself had taught her to cast aside all feminine reserve and self-respect, and his fickle heart had been captivated by another, long before the disclosures which were the ground of her death. Henry married his new love, Jane Seymour, the day after the execution of Anne (1536). The birth of Edward in the following year gratified the king's desire for a male heir; but the early death of Jane left him again without a queen. After an interval of more than two years Cromwell undertook to procure a suitable wife at the Protestant courts of Germany; but his ruin was not less complete than that of his patron Wolsey on a similar occasion, ten years before. Anne of Cleves found no favor in the king's eyes; she was divorced and pensioned off, while the enemies of Cromwell succeeded in sending him to the scaffold. Anne's place was occupied by Catherine Howard, till she, really guilty, was also executed (1542). For his sixth and last queen Henry married (1543) Catherine Parr, who proved a patient wife and an excellent nurse. During the last few years of Henry's reign, home affairs and the question of the religious revolution ceased to be the exclusive subject of interest. England and the neighboring powers were constrained to acquiesce for the time being in Henry's arrangement of things. Even the emperor cultivated his alliance. His foreign politics ended very much as they began—with a war against Scotland and France. The former arose out of certain border quarrel; the Scots were beaten at Solway Moss, but defeated an English force at Ancrum Moor. Scotland was ravaged to no purpose. The war with France (1543-46) was equally fruitless. Its chief feature was a threatened invasion by a formidable French fleet, which for some time was master of the Channel.

At home the most important point of interest was the struggle between the two factions, Protestant and Conservative, which had now for some years confronted each other—Norfolk and Bishop Gardiner of Winchester being the leaders of the latter, while the queen, Cranmer, and the earl of Hertford, uncle of young Edward, were at the head of the former. Cromwell had already fallen under the machinations of the Conservative party. Cranmer, and even the queen, were not quite safe from its attacks. The heads of that party now suffered at the close of the reign. Surrey was executed, and Norfolk was saved only by the death of the king. The effect of such measures was to make the prospects of Edward secure by confirming the power of his uncle Hertford.

Henry was anxious to arrange affairs for the accession of his son, as he felt his own life waning away. Though only in his fifty-sixth year he was unwieldy with disease and corpulency, and required to be wheeled from room to room. He died on January 28, 1547.

HENRY I., German king, was born in 876 in Saxony, of which his father, Otto, was duke. He distinguished himself in early youth by the courage and energy with which he warred against the Slavonic tribes to the east of his native duchy. Otto, who died in 912, appointed Henry his successor, not only as duke of Saxony but as lord of Thuringia and part of Franconia. Conrad I. resisted the claims of the young duke; but he was ultimately left in possession of all the lands his father had ruled. After Conrad's death Henry was chosen king by the Franconian and Saxon nobles, and he had not much difficulty in securing the acquiescence of the rest of Germany. In 933 the Hungarians demanded as usual the tribute which had till then been punctually paid, and when it was refused invaded Thuringia with a great army. Henry twice defeated them, and they were so overwhelmed by this misfortune that they did not enter Germany for some years, and were never again seen in the northern duchies. Having thus broken the power of all the chief enemies of his country, Henry took precautions for the future by establishing the marches of Schleswig, of Meissen and perhaps of Brandenburg. Toward the close of his life his position was so secure that he resolved to go to Rome and claim the imperial crown. In the midst of his preparations he died in 936 at Memleben, and was buried in St. Peter's church at Quedlinburg.

HENRY II., Holy Roman emperor, was born in 972. He was the son of Henry the Wrangler, duke of Bavaria, a grandson of King Henry I. In 995 he succeeded to the duchy of Bavaria, and six years afterward went to Rome with the young emperor Otto III., to whom he rendered important services. When Otto III. died, Henry, as the chief surviving representative of the house of Saxony, took possession of the insignia of the empire, and was crowned German king at Mainz on June 7, 1002. His most determined enemy during the greater part of his reign was Boleslaus II. of Poland. This ambitious and strong-willed prince annexed Bohemia, and during the king's absence in Italy broke into Lusatia and Meissen. Henry hurried back, defeated Boleslaus in 1005, and granted Bohemia in fief to Jaromir, son of the previous duke. Boleslaus, however, continued the war, which was not ended till 1018, when Henry was obliged to conclude peace. In 1014 Henry was crowned emperor at Rome by Benedict VIII., whom he had confirmed in the papal see in opposition to the antipope Gregory. At the request of Benedict the emperor returned to Italy in 1022 in order to drive back the Greeks, who were steadily pressing northward. In this enterprise he associated himself with the Normans, who thus became one of the

most important factors in the political life of Italy. Henry's health, which was always feeble, rapidly declined after this third visit to his southern dominions, and in 1024 he died.

HENRY III., Holy Roman emperor, was the son of Conrad II., the founder of the Franconian dynasty. He was born in 1017, and was elected German king in 1026, became in 1027 duke of Bavaria, and in 1038 duke of Swabia and king of Burgundy. He became the reigning sovereign of Germany in 1039, at the age of twenty-two. Of an upright and resolute temper, he soon made his power felt both in church and state. Henry was as distinguished in his wars as in his home government. He began in 1042 a series of campaigns in Hungary, where for the first time he asserted the supremacy of Germany. In Italy he was equally successful, not only maintaining his right to the Lombard crown, but establishing supremacy over the Normans in Apulia and Calabria. At a council of prelates in Sutri in 1046, he caused the rival popes, Benedict IX., Sylvester II. and Gregory VI., to be deposed, and raised to the papal see, as Clement II., Suitger, bishop of Bamberg. Three other German bishops, one after the other, were appointed to the same position; and as all of them were devout men and energetic administrators, they did much to purify the ecclesiastical system of Europe. Henry died in 1056 at Botfeld.

HENRY IV., Holy Roman emperor, son of Henry III., was born in 1050, and crowned German king at the age of four during his father's lifetime. After the death of Henry III. in 1056, the government was undertaken by the empress Agnes, the young king's mother. Henry III.'s vigorous rule, while it had secured the prosperity of the nation as a whole, had excited bitter discontent among the great nobles, and immediately after his death they began to make attempts to recover some portion of the independence he had taken from them. In 1062, Anno, archbishop of Cologne, succeeded in gaining possession of the king by enticing him on board a boat on the Rhine. Agnes then resigned her position, and Anno ruled in her stead. He was a harsh, bigoted, and despotic prelate, and excited Henry's bitter hatred by the sternness of his discipline. In his fifteenth year Henry was declared, in accordance with the Ripuarian Code, to have reached his majority, but the royal authority was really exercised by Adalbert, archbishop of Bremen, who aroused the jealousy of the princes both by his splendid style of living and by his opposition to their usurped powers. At a diet held in Tribur he was compelled to yield the first place once more to Anno. Anno caused Henry to marry Bertha, the daughter of the margrave of Susa, to whom he had for some time been betrothed. At first he regarded her with strong dislike; but after she had borne him a son in 1071 she succeeded in gaining his affections, and was afterward his most trusted friend and companion.

Henry's reign was one of the most troubled in German history. His chief anxieties began in consequence of Otto of Nordheim, duke of Bavaria, being charged with an intention of murdering him. Otto was declared to have forfeited his titles, and his lands were seized and overrun. Supported by Duke Magnus of Saxony he rebelled, but both princes were quickly subdued. A new rebellion was organized by Otto of Nordheim, who suddenly, at the head of 60,000 men, appeared before the Harzburg, a strong Saxon fortress in which Henry resided. He escaped, but he was looked upon so coldly by the princes that he found it expedient to yield nearly all the demands of his enemies. An opportunity of revenge was, however, created for him by the violence of a body of peasants, who destroyed a chapel connected

with the Harzburg and violated the graves of the king's brother and infant son. He had then no difficulty in obtaining an imperial army, and after defeating the rebels at Hohenburg in 1075, he imposed on them his own terms, and seemed to be on the point of asserting the ascendancy which had been exercised by Henry III.

Meanwhile Hildebrand had become pope as Gregory VII., and had already indicated his design of making the papacy supreme over all earthly authorities. Henry appealed to him to degrade those prelates who had associated themselves with the rebels. Instead of responding favorably to the appeal, Gregory called upon the king to answer to certain charges preferred against him by his subjects. Failing to realize how much power the papacy had acquired through the reforms effected by his father, Henry summoned a council of German prelates at Worms in 1076, and declared the pope deposed. The reply was a sentence of excommunication. Henry's adherents so rapidly fell away that a reconciliation with the pope was soon perceived to be absolutely necessary. Escaping from his enemies he crossed the Alps in the depth of winter, accompanied only by his wife and child and by a few faithful attendants. The nobles of Lombardy were not unwilling to take up his cause, but he preferred to hurry forward to the castle of Canossa, where Gregory was residing with his friend the Countess Matilda. There occurred the famous scene in which Henry, the highest of secular potentates, stood for three days in the courtyard of the castle, clad in the shirt of a penitent, and entreating to be admitted to the pope's presence.

The ban was removed; nevertheless the German princes elected Duke Rudolf of Swabia as their king, and they were soon openly supported by the pope, who resented Henry's persistent opposition to his great scheme for the deliverance of the clergy from the system of feudal investiture. Henry renewed his sentence of deposition against Gregory, and raised Guibert, archbishop of Ravenna, to the papacy as Clement III. After the death of the anti-king Rudolf in 1080 he went to uphold his rights in Italy, and in 1084 he gained possession of Rome, where Clement III. crowned him emperor. In Germany Count Hermann of Luxembourg had been chosen as successor to Rudolf, and in 1085 he defeated Henry near Würzburg; but in 1087 he voluntarily resigned his position, and soon afterward died. A third anti-king, Margrave Eckbert of Meissen, also died in 1089; and had Henry had no enemies outside his native kingdom there would then have been peace. But Victor III. and Urban II., the successors of Gregory VII. (who died in 1085), continued to oppose him, and in 1090 he was obliged to proceed to Italy for the third time to support Clement III., his own anti-pope. While engaged in this struggle he learned that his son Conrad had been induced by the papal party to rebel against him. Stunned by this unexpected blow, the emperor withdrew in disgust to a remote fortress, where he remained inactive for several years. In 1096 he recovered his energy, returned to Germany, and by timely concessions managed to overcome the opposition of his leading enemies. A diet at Mainz decided that Conrad had forfeited his right to the throne, and his brother Henry was proclaimed the emperor's successor. Pope Urban II., the anti-pope Clement III., and Conrad, all died within two years, and Henry had reason to hope that he would be able to end his life in quiet. But Paschal II., pursuing the policy of his predecessors, once more excommunicated the emperor, who was driven to despair by the fact of his son Henry putting himself at the head of the pope's supporters. The aged monarch, deceived by false promises, fell into his hands, and was detained as a

prisoner. He ultimately fled to Liège, where he might still have been able to bring an army together; but in 1106 he was relieved from his heavy cares by death.

HENRY V., Holy Roman emperor, son of Henry IV., was born in 1081. In 1098, his elder brother Conrad having forfeited his right to the throne by rebellion, he was appointed his father's successor. Six years afterward he himself rebelled against the emperor, toward whom he played the part of a thorough traitor. The papal party, with which he allied himself, took for granted that when he mounted the throne church and state would be instantly reconciled; but their hopes were disappointed. The main point for which Henry IV. had contended was the right of investing the bishops with ring and staff. When Henry V. succeeded him in 1116, Pope Pascal II. demanded that this right should be given up, but he replied that he could not resign powers which had been exercised by his predecessors, and the loss of which would imply that the ecclesiastical lands of Germany would be removed from secular control. In 1110 he entered Italy at the head of 30,000 men. Alarmed at this display of force, Pascal withdrew his claims, and a day was appointed for the coronation of Henry as emperor. The opposition of the Roman prelates made it impossible for the pope to proceed with the ceremony, whereupon he and his cardinals were made prisoners. Pascal then formally recognized the right of investiture, and Henry received the imperial crown. When the Germans had recrossed the Alps Pascal renounced the treaty he had concluded, and the emperor was excommunicated. Germany again became the scene of confused contests like those which had brought misery upon it during Henry IV.'s long reign. In 1116 the emperor went a second time to Italy and drove Pascal from Rome; and after Pascal's death he caused Gregory VIII. to be appointed pope. The extreme papal party, however, selected Gelasius II., who renewed the sentence of excommunication against Henry. The latter returned to Germany in 1119, and at a diet in Tribur succeeded in allaying the hostility of the more important among his enemies. Pope Calixtus II., who succeeded Gelasius in 1119, now found it necessary to offer a compromise; and the controversy between the empire and the papacy was for the time closed by the concordat of Worms, which was concluded in 1122. By this treaty it was agreed that at every election of a prelate the emperor should have the right of being present, either in person or through a representative, and that the chosen bishop, before being consecrated, should receive his lands and secular authority in fief of the crown. Notwithstanding this settlement Germany did not long enjoy peace, for a number of petty wars broke out which Henry was not strong enough to quell. He died at Nimeguen in 1125, and with him was extinguished the Franconian dynasty.

HENRY VI., Holy Roman emperor, the son of Frederick I., was born in 1115, and received the German crown in 1169. When his father started for Palestine at the head of the third crusade, Henry was made imperial vicar, and he succeeded to the throne after the news of his father's sudden death reached Germany, in 1190. Henry the Lion, who had been banished to England by Frederick I., returned to Germany after the departure of the latter for the Holy Land. Henry resisted him, but on becoming the reigning sovereign he concluded peace, and hastened to Rome, where he was crowned emperor in 1191. Through his wife, Constantia, he had a right to the throne of Sicily; but the Sicilian nobles had made Count Tancred, an illegitimate son of Constantia's brother, king. After receiving the imperial crown Henry advanced against Tancred, and the whole of southern Italy, except Naples, was quickly

in his possession. Before Naples his army was struck by pestilence, and he was forced to return to Germany. There he suppressed various private wars, and compelled Henry the Lion to acknowledge his supremacy. The great ransom which he received from Richard I. of England enabled him to fit out a fine army, and with this he descended upon Italy in 1194, and without much difficulty conquered the Sicilian kingdom. On his return to Germany it was easy for him, with the prestige he had now acquired, to enforce submission; and so great was his authority that, in 1196, he made attempts to secure that the crown should be declared hereditary in his family. He might have succeeded had he lived some years longer; but in 1197 he died at Messina.

HENRY VII., Holy Roman emperor, was born in 1282. He was the son of Henry II., count of Luxembourg, and was elected king in 1308, seven months after the murder of Albert I. He owed his election partly to the fact that he was comparatively unimportant, which led the electors to suppose that under him the powers of the princes would be exposed to no great danger. When he came to the throne Bohemia was subject to Henry of Carinthia, whom the people extremely disliked. The king at once displaced him, and enriched his own family by granting Bohemia, at the request of the Bohemians themselves, to his son John, whose claims were rendered secure by his marriage with Elizabeth, the daughter of Wenceslaus II. For some time no German king had sought the imperial crown; but Henry, who was of an imaginative temperament, could not forget the splendid dignities to which the wearer of the crown of Germany was entitled. Unfortunately, the easiest way in which Henry could obtain immediate power for his plans in Italy was to ally himself with the princes against the cities; and this was in most instances the course which he adopted. His visit to Italy was looked forward to with eagerness by the Ghibellines, whose hopes were expressed in words of glowing eloquence by Dante. He held aloof at first from both the great parties in the state, and was in consequence liked by neither. In 1312 he was crowned emperor in Rome, having previously received the iron crown in Milan. But while he was in Rome, Robert of Naples was there also, with a strong army, and in order to obtain adequate support, it was necessary for Henry to declare himself on the side of the Ghibellines. He then resolved to conquer Naples, but while advancing on this expedition, he died at Buonconvento, on August 24, 1313.

HENRY I. (1005-1060), king of France, son of King Robert and Constance of Aquitaine, and grandson of Hugh Capet, came to the throne in 1031. On his accession his mother, who favored her youngest son Robert, allied herself with the chief feudal nobles, and drove Henry to take refuge at the court of Duke Robert II. of Normandy. With the duke's help he soon broke up her league. Constance died in 1032, and Henry, by granting him the duchy of Burgundy, secured the goodwill of Robert his brother, who thus became head of the first house of Burgundy. After the death of Robert "the Devil," Henry, who had first supported William the Bastard, in 1053 and 1054, tried to weaken the power of the Normans. Leaguely himself with the count of Anjou, and calling his brother Eudes into the field, he invaded Normandy from Evreux. When, however, Eudes had been defeated at Mortemer, Henry drew back in haste, and left the Normans to themselves. In 1059 he had his eldest son Philip crowned as joint-king, and died in 1060.

HENRY II., king of France, the second son of Francis I. and Claude, was born in 1519, and succeeded to the throne in 1547. When only seven years old he

was sent by his father, with his brother the dauphin Francis, as a hostage to Spain in 1526, whence they returned after the conclusion of the peace of Cambray in 1529. In 1533 his father married him to Catherine de' Medici. Italian manners and politics entered with her into France, and long affected the history and fortunes of the country. Henry gathered round him a court which contrasted strongly with that of his father. Francis, with all his grave faults and selfishness, had fostered learning, had treated his people kindly, and had rarely checked even the Reformers. But Henry, under the influence of Diana of Poitiers, headed the strict Catholic movement; the escape of the learned from Paris to Geneva at his accession showed that not merely Huguenot doctrines but Renaissance studies were in peril. Immorality did not take flight, for Diana of Poitiers and Catherine de' Medici were at court, but it ceased to be gay and bright; men must be grave and severe, even in their vices. At first Diana of Poitiers and the grim old soldier Anne of Montmorency swayed the king; later, the two brothers Francis, duke of Guise, and Charles, cardinal of Lorraine, rose to power, with the marshal St. André; everything was done and given through one or other of these men. Catherine de' Medici was as yet completely in the background.

The final union of Brittany with France marks the opening year of the reign. In 1548 Henry won a great diplomatic triumph over the ministers of Edward VI. of England, by getting possession of Mary, queen of Scots, then only six years old; he had her educated in France, and eventually married to his son the dauphin Francis. In 1549 he appeared in Paris for the first time, and marked his presence by a great burning of Calvinists; and soon after he claimed back Boulogne, which had been promised to Francis I. by Henry VIII. After a successful campaign, he made the English Government, then extremely weak, cede Boulogne, and Henry entered the place in May, 1550.

Hitherto he had not come into collision with Charles V.; the time was now approaching when he would enter into contest with him, and permanently advance the borders of his kingdom, while he inflicted a great blow on the emperor. Though early in his reign he had dealt with the German Protestants, and with the Ottoman power, he had taken no active steps; now the league of German princes, headed by Maurice of Saxony, offered an opportunity not to be missed. Henry made a compact with the Swiss and Turks, and concluded a secret treaty (September 3, 1550) with the German princes; in 1552, by the league of Chambord, he undertook to seize the three bishoprics,—Metz, Verdun, and Toul. And so while Maurice drove the emperor from Innsbruck, Henry sent Montmorency into Lorraine. The bishoprics were won almost without a blow, and Henry was acknowledged as "avenger of Germanic liberty"; an attempt on Strasburg failed. After the siege of Metz by Charles V. in the winter of 1552-53, this district, French-speaking, though feudally under the empire, remained in French hands,—Metz till 1870, Toul and Verdun to this day.

In 1556 Henry, supporting the anti-Spanish policy of the "Theatine" pope, Paul IV., again made war with Spain. Francis of Guise was sent early in 1557 into Italy to oppose the duke of Alva. Anne of Montmorency went to the northern frontier; Gaspard of Coligny, who commanded in Picardy, was ordered to begin hostilities. These led to the disastrous battle of St. Quentin, in which the French were utterly defeated (August 10, 1557); it was followed by the fall of the town, at that time the chief bulwark of France to the north. Francis of Guise, recalled in haste from Italy,

redressed the balance at the expense of England by the capture of Calais (January, 1558), and the triumph of the house of Guise seemed complete when Mary Stuart was married to the dauphin in the same year; their niece, with her claims on the Scottish and English crowns, would now ascend the throne of France. The defeat of the French at Gravelines, the desire of Montmorency to escape from captivity, the wish of the High Catholics to have leisure to extirpate heresy, the sympathy of Philip with that aim, the accession of Elizabeth of England, all these things made peace necessary, and the treaty of Cateau Cambresis (April, 1559) closed the war. As a sequel to the peace high feast was held at Paris to celebrate the marriage of Henry's two daughters; in a tournament he received his death-wound from the captain of his Scottish guards, Montgomery. So ended Henry II., in his forty-first year. By Catherine de' Medici he had ten children, three of whom succeeded to the throne,—Francis II., Charles IX., and Henry III.

HENRY III., king of France, third son of Henry II. and Catherine de' Medici, was born in 1551 and succeeded to the throne of France in 1574. In his youth, as duke of Anjou, he was warmly attached to the Huguenot opinions, as we learn from his sister Margaret of Navarre; but his unstable character soon gave way before his mother's will, and both Henry and Margaret remained as choice ornaments of the Catholic church. Henry won two brilliant victories at Jarnac and Moncontour (1569), and thereby attracted the eyes of the Polish nobles, who elected him their king in 1573. He went to Warsaw, but, on the death of his brother Charles IX. in 1574, came back to France and assumed the crown. He returned to a wretched kingdom, torn with civil war. Now began that "reign of favorites" which has made his career a byword. His mother, ever balancing between parties, first favored the favorites, then went with the Huguenot chiefs. In these days the famous League was organized (see FRANCE), and Henry declared himself its head in 1576. He took but a feeble part in the sixth and seventh civil wars, and was little in earnest till, in 1584, the death of his younger brother, Francis, duke of Anjou, made Henry of Navarre next heir to the throne, and excited to the utmost the fierce passions of the Guises and the League. The Parisian development of the League under the "sixteen" (1585), with its devotion to Henry, duke of Guise, and its determination to exclude the heretic of Navarre, to depose the wavering Henry III., and to make Cardinal Bourbon king—this, as well as the menacing attitude of Philip II. of Spain, forced Henry III. to draw toward his distant cousin Henry of Navarre. He was driven to desperation by the commanding position assumed by the house of Guise; and in 1588 Henry of Guise and his brother the cardinal were assassinated by his orders. Henry III. now found himself powerless; early in 1589 he again joined Henry of Navarre, and with him laid siege to Paris. There he was murdered by one Jacques Clement, a priest. With Henry III. ended the direct line of the house of Valois.

HENRY IV., king of France, was born in the castle of Pau in 1553, being son of Antony of Bourbon, king of Navarre and duke of Vendôme, and Jeanne of Albret. By his father he was tenth in descent from Saint Louis, and only a very distant cousin to his predecessor, Henry III. His mother, a grand and noble lady, brought him up as a Calvinist. His education was rough and hard, and fostered that originality of character which so marked his life; his military training was under the great captain, Gaspard of Coligny. In 1571 he was wedded to the daughter of Catherine de' Medici, Mar-

garet of Valois; and on his mother's death in 1572 he became king of Navarre. The massacre of St. Bartholomew found him in Paris; but his life was spared on his making a profession of Catholicism, which lasted till he succeeded in escaping from court in 1575. Thenceforward he became the acknowledged head of the Huguenots, and by his dashing bravery kept life in their spirited forces. No man was better fitted for such work; he had all the qualities of a guerrilla leader, though he was not a great general. His success at Coutras (1587) and the joyousness and generosity of his character endeared him to his followers, while it secured the respect even of his opponents. After the death of Henry III. he was recognized as king of France by only a portion of the army then besieging Paris (August 4, 1589); the Catholic "Politiques" in the army stood aloof and disbanded; the Huguenots formed the only sound nucleus of his power. At Arques (1589) and Ivry (1590) he brilliantly defeated the Leaguers, and resumed the siege of Paris; Alexander of Parma, however, prevented him from taking Rouen (1592); muchless could he take Paris. Finding affairs hard, and desiring to be a king and not a guerrilla-captain, in 1593 Henry professed Catholicism. By this step he struck a deadly blow at the League and made powerless the intrigues of Philip II. For between the fanatical Catholics on one side and the Huguenots on the other lay the great bulk of Frenchmen; the "Politique" party had become more and more powerful, until at length it was felt to be the true national party. The only thing which kept it from Henry was the difference of faith; that barrier removed, all France at once joyfully accepted him as king. The Leaguers became almost a foreign body; the Huguenots gloomily accepted his triumph, bought, as they held, at cost of principle. After the battle of Fontaine-Francaise in 1595 the Spanish and Leaguers were driven out of Burgundy, and the recovery of Amiens from the Spaniards in 1596 secured Picardy and the northern frontier.

After 1598 the energies of Henry IV. were given to the restoration of his country, which, in nearly forty years of civil war, had suffered terribly; the organizing genius of Maximilian of Bethune, duke of Sully, restored the finances; agriculture, manufactures and commerce made marvelous advances. Henry also upheld the authority of France; in 1601 he acquired Bresse, Bugey and Valromey from Savoy. He supported the Netherlands against Spain, and he was preparing a great army, which, in combination with the Dutch under Maurice of Nassau, was to interfere in the tangled Cleves-Juliers question, when he was assassinated by Ravailiac on May 14, 1610.

Henry IV. left no children by his first wife, Margaret of Valois; by his second, Marie de' Medici, he had three sons and three daughters—Louis, who succeeded him as Louis XIII.; a child, who died in 1611; Gaston, duke of Orleans, the meanest of the race; Elizabeth, wife of Philip IV., king of Spain; Christine, wife of Victor Amadeus, duke of Savoy; and lastly Henriette Marie, queen of England, spouse of Charles I. He also left behind him several natural children, of whom the most celebrated was César, duke of Vendôme, son of the famous Gabrielle d'Estrées.

HENRY I., king of Portugal, born at Lisbon, January 31, 1512, was the third son of Emanuel the Fortunate, was destined for the church, and in 1532 was raised to the archiepiscopal see of Braga. In 1542 he received the cardinal's hat, and in 1578, when he was called to succeed his grandnephew Sebastian on the throne, he held the archbishoprics of Lisbon and Coimbra as well as that of Braga, in addition to the wealthy abbacy of Alcobazar. As an ecclesiastic he was pious, pure, simple in his mode of life, charitable,

and a learned and liberal patron of letters; but as a sovereign he proved weak, timid, and incapable. On his death in 1580 after a brief reign of seventeen months the male line of the royal family which traced its descent from Henry, first count of Portugal (c. 1100), came to an end; and all attempts to fix the succession during his lifetime having ignominiously failed, Portugal became an easy prey to Philip II. of Spain.

HENRY I., king of Castile, son of King Alphonso "the Noble," by Eleanor, daughter of Henry II. of England; succeeded his father in 1214, and was killed by the falling of a tile in 1217, after a reign of only two years and nine months. He was succeeded by Ferdinand III., son of his sister Berenguela.

HENRY II., king of Castile, surnamed *el Bastardo* or *de la Merced*, was one of the six illegitimate sons of King Alphonso "the Avenger," and consequently half-brother to Pedro the Cruel, who legally succeeded to the throne of Castile in 1350. His mother was Leonora de Guzman. The extraordinary series of cold-blooded murders which earned for Pedro his unenviable surname encouraged Henry, then known as count of Trastamara, to lead repeated rebellions, in which, with the aid of the French under Du Guesclin, and in spite of the opposition of the English under the Black Prince, he was ultimately successful in 1369. He immediately proceeded to direct his arms against the most formidable of his numerous enemies, King Ferdinand of Portugal, and by four campaigns, during the last of which he forced his way to the very gates of Lisbon (March, 1373), succeeded in establishing a favorable peace. At the same time he entered into a treaty with the king of Navarre, which subsisted, however, for only three years; in 1375 friendly relations with the king of Aragon were formed, which were cemented by the marriage of the daughter of the latter to Don Juan of Castile. The reign of Henry II., which was devoted rather to defensive than to aggressive warfare, was not marked by any of the usual exploits against the Moors, but it is distinguished in the annals of Castile by some noteworthy improvements in legislation and reforms in the administration of justice, sanctioned in the cortes of Toro in 1369 and 1372; and Spanish historians also mention with special pride the defeat of the English by the Spanish fleet at Rochelle in 1372. Henry died of poison, it is supposed, on May 30, 1379, and was succeeded by his son John (Juan) I.

HENRY III., king of Castile, surnamed *el Doliente* (the sickly), was born in 1379, and succeeded his father John I. in 1390. During his minority, the kingdom was in a constant state of disturbance, bordering upon civil war; Henry at last resolved to take the reins of government entirely into his own hands (1393). He succeeded within two years in quelling the turbulence of his nobles, in establishing his own popularity with the body of the people, and thus in effecting the pacification of his kingdom. The only foreign war during this reign was that with Portugal, which terminated in the peace of 1399; a great expedition against the kingdom of Granada, for which extensive preparations had been made, and for which large grants from the cortes held in Toledo in 1406 had been obtained, was brought to an abrupt termination by the death of Henry at that city on December 25th of the same year. Henry III. was succeeded by John II., his eldest son by Catherine of Lancaster, whom he had married in 1393.

HENRY IV., king of Castile, surnamed *el Impotente* (the impotent), and sometimes *el Liberal* (the spendthrift), the eldest son of John II. by his first wife, Mary of Aragon, was born at Valladolid on January 6, 1425. As prince of Asturias, he took a prominent and generally an unfilial part, in most of the disturbances of his

father's reign; in 1445 a pitched battle between the king and the prince was prevented only at the last moment by the intervention of the clergy and some of the nobles, and peace was not finally secured until 1450, when Pope Nicholas V. issued his bull of excommunication against all those in the peninsula who, by perplexing the affairs of the sovereign, were disastrously helping the cause of the infidels. In 1440 Henry had, in accordance with a treaty signed in 1436, been united to Blanche of Aragon; but this marriage, which had not been happy, and which had given cause for many scandalous reports, he dissolved in 1453, shortly before his accession to the throne on his father's death in July of that year. He began his reign with a great show of energy against the Moors; but the boldness of his intentions contrasted strangely with the feebleness of his execution. In 1465 occurred at Avila the extraordinary scene, so often described, of the king's deposition in favor of his brother Alphonso; this was followed in 1468, shortly after Alphonso's death, by the election of his sister Isabella, who, however, declined to accept the proffered crown. In the same year Henry was forced to repudiate his wife Joanna of Portugal, and to disinherit her daughter Juana (la Beltraneja) whom he had unsuccessfully attempted to put forward as also his; and thus the succession became fixed in favor of Isabella, who was married to Ferdinand of Aragon in the following year. Henry died at Madrid on December 12, 1474.

HENRY I., king of Navarre, surnamed *le Gros*, third count of Champagne, was the youngest son of Theobald I. of Navarre, by Margaret of Foix, and succeeded his eldest brother Theobald II. in December, 1270. His proclamation at Pamplona, however, did not occur till March of the following year, and his coronation was delayed until May, 1273. After a brief reign, characterized it is said by dignity and talent, he died in July, 1274, suffocated, according to the generally received accounts, with his own fat. In him the male line of the counts of Champagne, kings of Navarre, became extinct.

HENRY II., or Henri d'Albret, titular king of Navarre, born at Sanguessa in April, 1503, was the eldest son of Jean d'Albret by Catherine of Navarre; and on the death of the latter in exile in June, 1516, succeeded his parents in all their claims against Ferdinand the Catholic, assuming under the protection of Francis I. of France the title of king of Navarre. After the ineffectual conferences at Noyon (1516) and at Montpellier 1518, an active effort was made in 1521 to establish him in the *de facto* sovereignty; but the French troops which, under André de l'Esparre, had seized the country, were ultimately expelled by the Spanish viceroy, the duke of Najera. Henry, who along with Francis was taken prisoner at the battle of Pavia (1525) but afterward contrived to escape, married Margaret, the only sister of the latter, in 1526, and by her became the father of Jeanne d'Albret, the mother of Henry IV. of France. He died at Pau on May 25, 1555.

HENRY III. of Navarre. See HENRY IV. of France.

HENRY, PRINCE (1394-1460), of Portugal, surnamed "the navigator," to whose enlightened foresight and perseverance the human race is indebted for the maritime discovery, within one century, of more than half the globe, was born at Oporto, on March 4, 1394. His father was João I., under whose reign Portugal first began to recover from her subjugation by the Moors, and to assume a prominent position among the nations of Europe; his mother was Philippa, daughter of John of Gaunt. Prince Henry and his elder brothers, Duarte and Pedro, were sent out in 1415 on an expedition against the important Moorish city of Ceuta,

which, after much hard fighting they succeeded in taking. All the princes distinguished themselves at the siege, but Prince Henry so pre-eminently that, but for his own entreaties, his father would have knighted him in precedence of his brothers. His renown after this became so high that he was invited severally by the pope, the emperor, and the kings of Castile (Juan II.) and England (Henry V.) to take command of their respective armies. The prince, however, had set his mind on other and larger plans, involving no less than the hope of reaching India by the south point of Africa. To this end he had several encouragements; the geographical position of Portugal was in his favor; the large revenues of the order of Christ, of which he was grand-master, provided him with means; and he had contrived to gather important information from the Moors with regard to the coast of Guinea and the populous nations of the interior of Africa. Accordingly in 1418-19 he took up his abode on the extreme southwestern point of Europe, the promontory of Sagres, in Algarve, of which kingdom he was made governor in perpetuity, with the purpose of devoting himself to the study of astronomy and mathematics, and to the direction and encouragement of the expeditions which he proposed to send forth. There he erected an observatory, the first set up in Portugal, and at great expense procured the services of one Mestre Jacome from Majorca, a man very skillful in the art of navigation and in the making of maps and instruments, to instruct the Portuguese officers in those sciences. An account has already been given of his principal explorations in the article GEOGRAPHY. At first his efforts seemed to be crowned with little success, and his various expeditions called down upon him much obloquy from the nobles, who complained of such an amount of useless expenditure; but on the prince vituperation fell harmless. The king died in 1433, and the troubles which followed occupied Prince Henry until 1440. In the following year Cape Branco was reached, and in 1443 intercourse was established with negro states in Senegal and Gambia. In 1444-5 were discovered the river Senegal, Cape Verd, Cape St. Anne, Cabo dos Mastos, and the Rio Grande. During the later years of his life Gomez and others made important voyages of discovery in Prince Henry's service. He died November 13, 1460, in his town on Cape St. Vincent, and was buried in the church of St. Mary in Lagos, but a year later his body was removed to the superb convent of Batalha.

HENRY THE LION, duke of Saxony and Bavaria, son of Henry the Proud, was born in 1129. After the death in 1139 of his father, who had been deprived of his possessions by Conrad III., the bravery and energy of his mother, Gertrude, and his grandmother, Richenza, secured to him the duchy of Saxony. Shortly after coming of age he at the diet of Frankfort, in 1147, demanded also the restoration of Bavaria, but was refused, upon which, along with his uncle Welf VI., he made an unsuccessful attempt to seize it by force of arms. In 1154 he, however, received from Frederick I. the formal recognition of his claims to its possession, and in 1156 Henry Jasomirgott was compelled to deliver it up to him. Besides distinguishing himself in the wars of Frederick in Italy, Henry now devoted his energies to establishing his power in his own dominions, both by conquest and by encouraging agriculture and trade. He extended the boundaries of Saxony beyond the Elbe by successful battles against the Slavs, founded Munich in Bavaria, colonized Mecklenburg and Holstein, and fostered the growth of Hamburg and Lübeck. In February, 1168, Henry, having previously divorced Clementia of Zähringen, married Matilda, daughter of Henry II. of England; and, shortly after his return

from a pilgrimage to the Holy Land in 1172, began to treat the emperor with coldness and to revive the traditional rivalry of his race with the Hohenstaufens. He took no part in the Italian expedition of 1174, and in 1176 his sudden desertion of Frederick in the crisis of his struggles with the Lombard cities resulted in the disaster at Legnano. On Frederick's return from Italy in 1177 Henry was summoned to appear before him at the diet of Worms, and declining to do so he was placed under the ban of the empire, and his lands divided among other princes. For more than a year he endeavored to resist the execution of the imperial decree, but he found it necessary at last, in November, 1181, to give in his submission to Frederick, who, on condition that he remained three years in England, agreed to reinstate him in the possession of Brunswick and Lüneburg. Having in 1189 refused to accompany Frederick on his crusade, he was again compelled to withdraw to England, but shortly after Frederick's departure he returned, and, concluding an alliance with the archbishop of Bremen, made a second attempt to recover his territories; but, though at first he gained several important victories, he was ultimately compelled, in July, 1190, to conclude a peace at Fulda, which secured to him scarcely any advantages from the contest. Emboldened by the hostile alliance formed against the emperor Henry VI., in 1192, he again renewed the struggle; but after Richard of England fell into the hands of the emperor in the following year, he found it necessary again to give in his submission; and shortly afterward a pledge of amity between the two houses was given through the marriage of the eldest son of Henry the Lion to Agnes, niece of Frederick I., and cousin of the reigning emperor. Henry died August 6, 1195, at Brunswick, and was buried in the church of St. Blaise.

HENRY THE DEACON—variously called of Cluny, because he was at one time a monk of that rule, of Lausanne, because he is believed to have first appeared as a preacher of repentance there, and of Toulouse, because his later years were passed in that city and neighborhood—founder of the anti-sacerdotal sect of *Henricians*, was of Swiss or Italian extraction (his birthplace is unknown), and was born toward the end of the eleventh century.

HENRY OF GHENT. The scholastic writer generally known by this name was born probably about 1217 in the district of Mude, near Ghent.

HENRY OF HUNTINGDON, an English chronicler of the twelfth century, born, it is likely, between 1080 and 1090.

HENRY, JOSEPH, an eminent American physicist, was born in Albany, N. Y., December 17, 1797. He received his education at an ordinary school, and afterward at the Albany academy. On finishing his academic studies he contemplated adopting the medical profession, and prosecuted his studies in chemistry, anatomy and physiology with that view. He occasionally contributed papers to the Albany institute, in the years 1824 and 1825, on chemical and mechanical subjects; and in the latter year was appointed assistant engineer on the survey of a route for a State road from the Hudson river to Lake Erie. This diversion from his original bent gave an inclination to the career of civil and mechanical engineering; and in the spring of 1826 he was elected by the trustees of the Albany academy to the chair of mathematics and natural philosophy in that institution. In the latter part of 1827 he read before the Albany institute his first important contribution, "On some Modifications of the Electro-Magnetic Apparatus." In June, 1828, and in March, 1829, he exhibited before the institute small electro-magnets closely and repeatedly wound with silk-covered wire, which had

a far greater lifting power than any then known. Henry appears to have been the first to adopt insulated or silk-covered wire for the magnetic coil; and also the first to employ what may be called the "spool" winding for the limbs of the magnet. He was also the first to demonstrate experimentally the difference of action between what he called a "quantity" magnet excited by a "quantity" battery of a single pair, and an "intensity" magnet with long fine wire coil excited by an "intensity" battery of many elements, having their resistances suitably proportioned. He pointed out that the latter form alone was applicable to telegraphic purposes. Henry's "quantity" magnets acquired considerable celebrity at the time, from their unprecedented attractive power—one lifting 750 pounds, another 2,300, and a third 3,500.

In 1831 he arranged a small office-bell to be tapped by the polarized armature of an "intensity" magnet, whose coil was in continuation of a mile of insulated copper wire, suspended about one of the rooms of his academy. This was the first instance of magnetizing iron at a distance, or of a suitable combination of magnet and battery being so arranged as to be capable of such action. It was, therefore, the earliest example of a true "magnetic" telegraph, all preceding experiments to this end having been on the galvanometer or needle principle. About the same time he devised and constructed the first electro-magnetic engine with automatic polechanger. In 1832 he discovered the induction of a current on itself, in a long helical wire, giving greatly increased intensity of discharge (Silliman's *Am. Jour. Sci.*, July, 1832, xxii. 408). In 1832 he was elected to the chair of natural philosophy in the New Jersey college at Princeton. In 1834 he continued and extended his researches "On the Influence of a Spiral Conductor in increasing the Intensity of Electricity from a Galvanic Arrangement of a Single Pair." In 1835 he combined the short circuit of his monster magnet (of 1834) with the small "intensity" magnet of an experimental telegraph wire, thereby establishing the fact that very powerful mechanical effects could be produced at a great distance by the agency of a very feeble magnet used as a circuit maker and breaker, or as a "trigger"—the precursor of later forms of relay and receiving magnets. In 1838 he made important investigations in regard to the conditions and range of induction from electrical currents—showing that induced currents, although merely momentary, produce still other or tertiary currents, and thus on through successive orders of induction, with alternating signs, and with reversed initial and terminal signs. He also discovered similar successive orders of induction in the case of the passage of frictional electricity. Among many minor observations, he discovered in 1842 the oscillatory nature of the electrical discharge, magnetizing about a thousand needles in the course of his experiments.

In December, 1846, Henry was elected secretary and director of the Smithsonian Institution, then just established. While closely occupied with the exacting duties of that office, he still found time to prosecute many original inquiries—as into the application of acoustics to public buildings, and the best construction and arrangement of lecture-rooms, into the strength of various building materials, etc. Having early devoted much attention to meteorology, both in observing and in reducing and discussing observations, he (among his first administrative acts) organized a large and widespread corps of observers, and made arrangements for simultaneous reports by means of the electric telegraph, which was yet in its infancy. He was the first to apply the telegraph to meteorological research, to have the atmospheric conditions daily indicated on a large map,

and to utilize the generalizations made in weather forecasts, and the first to embrace a continent under a single system — British America and Mexico being included in the field of observation. From 1868 Henry continued to be annually chosen as president of the National Academy of Sciences; and he was also president of the Philosophical Society of Washington, from the date of its organization in 1871. He died at Washington, May 13, 1878.

HENRY, MATTHEW, the author of the well-known and justly popular *Exposition of the Old and New Testaments*, was born in England, October 18, 1662. He was the son of Philip Henry, one of the 2,000 ministers who were ejected from their livings in 1662 for refusing to conform to the Act of Uniformity. Unlike the majority of his fellow sufferers, Philip Henry, who, through his wife, was the possessor of private means, was spared all personal privation or hardship as the consequence of his nonconformity, and was thus enabled to give a good education to his son. Having received this preliminary education from his father and a tutor named Turner, Henry was next removed to an academy at Islington, whence he proceeded to become a student of law at Gray's Inn. His legal studies, however, had not advanced far when he relinquished them for theology, to which he thenceforth devoted himself. In 1687 he became minister of a Presbyterian congregation at Chester, whence, in 1712, he was translated to Hackney. Two years later (June 22, 1714), he died suddenly of apoplexy at Nantwich, while on a journey from Chester to London. Henry's *Exposition*, the work by which he is now chiefly remembered, is a commentary of a practical and devotional rather than of a critical kind, ranging over the whole of the Old Testament and extending into the New as far as to the end of the Acts.

HENRY, PATRICK, statesman and orator, was born at Studley, Hanover county, Va., May 29, 1736, the second son in a family of nine children. His father, John Henry, an emigrant from Aberdeen, Scotland, was a nephew of Robertson the historian, and had risen to some eminence in the country, filling the offices of surveyor and presiding magistrate. Patrick Henry was educated at a little school near his home; and, after the age of ten, by his father, who had opened a grammar school at his residence. In early life he showed no marked proficiency in his studies, except perhaps in mathematics, but was noted chiefly for a love of outdoor sports. At fifteen he became clerk in a country store; and at sixteen he entered into partnership as storekeeper with his elder brother, but the business was unsuccessful, and a second attempt at store-keeping ended likewise in failure. Meanwhile the indifference to learning which marked his boyhood was replaced by a love of history, especially that of Greece and Rome. At twenty-four, by his admission to the bar, Henry entered on the career that eventually brought him fame and fortune, although his income for some years was in keeping with his lack of previous preparation. At twenty-seven he won his first triumph, as counsel for the collector of the county, in what became known as "the parson's cause." His unexpected display of eloquence on the side of the people procured him an extravagant recognition and the title of "the orator of nature." Business poured in upon him, his popularity concealed his deficiencies; and his success was assured. In 1765 he was elected to the House of Burgesses, where he distinguished himself as the author of certain resolutions against the Stamp Act, the last of which — providing that "the General Assembly of this colony have the sole right and power to lay taxes and impositions upon the inhabitants of this colony" — though passed by a majority of only one, was

the keynote of the struggle for independence. In 1769 he was admitted to practice in the general court, where he attained eminence in criminal cases before juries. In 1773 he was a member of the "committee of correspondence for the dissemination of intelligence between the colonies." In the following year he was chosen delegate to the Virginia convention, which was the first public assembly to recommend an annual "General Congress," and to the "Old Continental Congress;" but his success there as an orator failed to conceal his defects as a practical statesman. In 1775, in the Virginia convention, he delivered a remarkable speech in moving that the "colony be immediately put in a state of defense," and at the head of a body of militia he forced the royal officials to pay £330 for powder clandestinely removed by order of Governor Dunmore. He was appointed by the convention colonel of the first regiment and commander of all the forces to be raised in Virginia, but a misunderstanding with the "committee of safety" led to his resignation. He was a member of the second Continental Congress of 1775, and of the Virginia convention of 1776, which had been elected "to take care of the republic," the royal governor having fled. They framed a new constitution, and elected Henry the first republican governor, on the first ballot. He was reelected in 1777 and 1778. In 1780 he became a member of the legislature, where he continued until he was again elected governor in 1785. In 1786 he withdrew through the pressure of debt, having "never been in easy circumstances." In 1787 he was chosen a delegate to the "Federal Constitutional Convention," but did not attend. He had resumed his practice to better his fortunes. In 1788 he was a delegate to the Virginia convention for ratifying the Federal Constitution, which he vehemently opposed as dangerous to the liberties of the country. In 1791 he declined reelection to the legislature, continuing, through necessity rather than choice, the practice of the law, but usually in great and remunerative cases only. Finally, in 1794, having not only paid his debts but secured affluence, he withdrew to private life. In 1795 he declined the position of secretary of state in Washington's cabinet, in 1796 the nomination for governor of Virginia, and in 1797 the mission to France, offered by President Adams. In 1799, however, he suffered himself to be elected to the State legislature, where he wished to oppose what he deemed the dangerous doctrine of the Virginia resolutions of 1798; but he did not take his seat, his death occurring on June 6th.

HENRY, ROBERT (1718–1790), the author of the *History of Great Britain written on a new plan*, was the son of a farmer, and was born in the parish of St. Ninians near Stirling, Scotland. For the volumes published in his lifetime Henry realized as much as £3,300, and through the influence of Lord Mansfield he was in 1781 rewarded with a pension of £100 a year from George III. In 1784 he received the degree of D.D. from the university of Edinburgh. He died in 1790 before his tenth volume was quite ready for the press.

HENRY, WILLIAM, a distinguished chemist, son of Thomas Henry, an apothecary and author of some works on chemistry, was born at Manchester, England, December 12, 1775. After completing his education at an academy in Manchester, he was for some years private secretary to a physician, and in 1795 began the study of medicine at the university of Edinburgh. For some time he practiced as a physician in Manchester, but, on account of delicate health, was ultimately compelled to retire from his profession. He nevertheless carried on his original researches in chemistry, for which he found great facilities in connection with his father's business, and from 1797 till his death he continued to

enrich the *Transactions* of the Royal Society with contributions on his favorite science, especially in regard to aëriform bodies. His first communication was an attempt, in opposition to Austin, Beddoes, and others, to establish the title of carbon to rank among the elementary bodies, but, discovering afterward a fallacy in his reasoning, he corrected it in a subsequent paper. In 1800 he published in the *Philosophical Transactions* his experiments on muriatic acid gas, made with the view of disengaging an imaginary unknown element supposed to be associated with oxygen in the composition of the gas; but after the discovery of the real nature of the acid by Davy he was one of the earliest converts to the new theory. In 1803 he published his elaborate experiments on the quantity of gases absorbed by water at different temperatures and under different pressures, with the result of establishing the law that "water takes up of gas, condensed by one, two, or more additional atmospheres, a quantity which would be equal to twice, thrice, etc., the volume absorbed under common pressure of the atmosphere." In 1808 he described in the *Philosophical Transactions* a form of apparatus adapted to the combustion of larger quantities of gases than could be fired in eudiometric tubes. In the same year he was chosen a fellow of the Royal Society; and in 1809, for his valuable contributions to the *Transactions* of the society, he was awarded the Copley gold medal. For the next fifteen years he continued his experiments on the gases, making known the results of them from time to time to the Society. He died September 2, 1836.

HENRYSON, ROBERT (c. 1425–c. 1506), one of the early Scottish poets, and the author of the first specimen of the pastoral poetry of his country, is usually designated schoolmaster of Dunfermline; and according to tradition he was the ancestor of the family of Henryson or Henderson of Fordell, in the county of Fife, one of whom, James Henryson, was king's advocate and justice-clerk in 1494. Of the poet's parentage and early history, however, no certain information can be discovered.

HENSLOWE, PHILIP, a contemporary of Shakespeare, whose name continues of interest from his intimate association with the history of the theater during the great dramatist's career. Originally, it would appear, a dyer and afterward a starchmaker, and ready to turn to any profitable speculation, he probably began his connection with the stage in 1584 by becoming "joint lessee of the Rose theater on the Bankside, or of the ground on which it stood." From 1591 to his death in 1616 he was in theatrical partnership with the more famous Edward Alleyn, who in 1592 married his step-daughter, Joan Woodward. (See ALLEYN.)

HENZADA, a district in Pegu division, British Burmah, with an area of 4,047 square miles. It is bounded on the north by the Prome district, on the east by the Pegu Yomas, on the south by Rangoon, Thonkhwa, and Bassein districts, and on the west by the Arakan Yoma range. Henzada district stretches from north to south in one vast plain, forming the valley of Irawadi, and is divided by that river into two nearly equal portions. This country is protected from inundation by immense embankments, so that almost the whole area is suitable for rice cultivation.

HEPATICA. See LIVERWORT.

HEPHÆSTION, son of Amyntor, a Macedonian of Pella, is celebrated as the friend of Alexander the Great. The two, according to Quintius Curtius, were companions in childhood, but beyond this old standing connection we find no evidence of such qualities in Hephæstion as deserved the passionate attachment of Alexander. In the later campaigns of Alexander in Bactria and India,

we find Hephæstion charged with important commands. He was rewarded with a golden crown and the hand of Drypetis, the daughter of Darius and sister of Alexander's own wife Statira, (324 B.C.) In the end of the same year he died suddenly at Ecbatana.

HEPHÆSTION, a grammarian of Alexandria, author of a work on Greek meters. This work is most valuable as the only complete work on the subject that has been preserved.

HEPHÆSTUS, a word of uncertain derivation but certainly pre-Greek in formation, denotes among the Greeks a god who represents the power of fire and its appliance in the operations of daily life, corresponding to the Latin Vulcan.

HERA, a word of which many different derivations have been proposed, is the name of a Greek goddess, corresponding to the Latin Juno, who according to the conventional type is the wife of Zeus and queen among the gods of Olympus. In the literature of the Greeks Hera fills a very conspicuous place; the strong, haughty, and rebellious character, full of intense hatreds and likings, which was associated with her, made her a picturesque and dramatic figure. According to this conception of her, she was daughter of Cronus and Rhea, and at once sister and wife of Zeus. She was always the bitter enemy of all the heroines who were the successive objects of her husband's love, and her persecution of them and of their children often forms the theme of poets from the *Iliad* downward. This type, which is the familiar one in all literature, had never any real existence in religion; but had been gradually elaborated by poets from the actual deity worshiped in various parts of Greece, and from the legends transmitted to the Greeks from earlier races.

HERACLEA, or HERACLEIA (in French, *Héraclée*), the name of several ancient cities in various parts of the area of Greek colonization, so called in honor of Heracles or Hercules.

I. HERACLEA, a city of Magna Græcia, which lay between the rivers Aciris and Siris, not far from the shores of the Gulf of Tarentum, near the site of the modern village of Policoro. It appears to have been a joint colony of the Tarentines and Thurians, and to have risen after the destruction of the neighboring city of Siris.

II. HERACLEA, a city of Sicily, at the mouth of the Halycus (the modern Platani), not far from the promontory now known as Capo Bianco. It was distinguished from the other Heracleas by the surname of Minoa, which was explained as referring to its foundation by Minos of Crete.

III. HERACLEA PONTICA, a city on the coast of Phrygia in Asia Minor, easily identified with the modern Bender Eregli or Ereklî, at the mouth of the Kilidj-su on the Black Sea. It was founded by a Megarian colony, which soon subjugated the native tribe of the Mariandynians, and extended its power over a considerable territory. The prosperity of the city, rudely shaken by the Galatians and the Bithynians, was utterly destroyed by Aurelius Cotta in the Mithridatic war.

IV. HERACLEA SINTICA, a town in Thracian Macedonia, to the south of the Strymon, the site of which is marked by the village of Zervókhori, and identified by the frequent discovery of local coins.

V. HERACLEA, a town on the borders of Caria and Ionia, near the foot of Mount Latmus, whence it is usually distinguished as the Latmian. In its neighborhood was the burial cave of Endymion.

For Heraclea Trachinia see TRACHIS, and for Heraclea Perinthus see PERINTHUS.

Heraclea was also the name of one of the Sporades, between Naxos and Íos, which is still called Raklia, and

bears traces of a Greek township with temples to Tyche and Zeus Lophites.

HERACLEON, a Gnostic who flourished about 125 A.D., probably in the south of Italy or in Sicily, is generally classed by the early heresiologists with the Valentinian school of heresy.

HERACLES. See HERCULES.

HERACLIDES, surnamed PONTICUS, a Greek miscellaneous writer who flourished in the fourth century B.C., was born at Heraclea in Pontus. Removing to Athens, he is said to have been a disciple successively of Speusippus, Plato, and Aristotle. According to Suidas, the second of these philosophers, on departing for Sicily, left his scholars in charge of Heraclides. The latter part of his life was spent at Heraclea.

HERACLITUS, of Ephesus, one of the most subtle and profound of the metaphysicians of ancient Greece, has only of late years had his true position assigned to him in the history of philosophy. The true position of Heraclitus is that of the founder of an independent metaphysical system, which sought to get rid of the difficulty, so prominent in the Eleatic philosophy, of overcoming the contradiction between the one and the phenomenal many, by enunciating, as the principle of the universe, "Becoming," implying, as it does, that everything is and at the same time, and in the same relation, is not.

HERACLIUS, emperor of the East, was born in Cappadocia about 575. He was brought into notice by his heading a successful revolt against the emperor Phocas in 610, when he usurped the usurper's throne. Heraclius appears to have set himself to the task of reorganizing both state and army, a labor which had probably occupied him since his accession. He was menaced on the west by the fierce tribe of the Avars, who were casting longing eyes on the riches of the imperial city; but, in 620, he succeeded in making a treaty with them. In 621 Heraclius led an army into camp in Asia Minor, and devoted himself with ardor to the drilling of his inexperienced troops. Next year he led his forces against Persia, and, within five years, in a series of brilliant campaigns that placed him side by side with the greatest generals of the world, he overthrew the pride of that empire, drove its monarch a fugitive from his throne, and enriched his exulting troops with untold wealth. The true cross, carried from Jerusalem by the Persians, was restored to Christian hands. Heraclius returned in triumph to Constantinople, which had in his absence two years before successfully repulsed a combined assault by the Avars and Persians; and, in 629, he proceeded to Jerusalem to restore solemnly the holy relic to its ancient place. But he was not long to enjoy the peaceful fruits of victory. A mighty power had been steadily growing up in the hot sands of Arabia, and was now coming to measure its strength with that of the Roman empire. In 632 the Mohammedans invaded Syria; and, overthrowing the armies sent to oppose them, in six years they made themselves masters of the country. Egypt next fell before Islam, and, in 640, that fair province of the empire was Mohammedan. The people of Asia Minor alone successfully resisted the advancing Saracens. Heraclius seems meanwhile to have sunk into a sort of lethargy, as though his efforts in Persia had completely exhausted him, and, in 641, he died.

HERALDRY, though etymologically denoting all the business of the herald, has long in practice been restricted to one part of it only, and may be defined as the art of blazoning or describing in proper terms armorial bearings. It treats also of their history, of the rules observed in their employment and transmission, of the manner in which by their means families and certain

dignities are represented, and of their connection with genealogies and titular rank.

Particular symbols have in all ages been assumed by the various families of mankind, civilized and uncivilized. Such were the lion of the tribe of Judah, the S. P. Q. R. upon the standards of ancient Rome, and the eagle surmounting them, the tattoo marks of the savages of America and the Pacific, the Danish raven, and the white horse of Saxony, which still remains carved upon the chalk downs of western England. Heraldry, however, is a purely feudal institution, coëval with close armor, devised possibly in Germany, adopted and improved in France, Spain, and Italy, and imported into England by the Norman invaders and settlers. Its figures have little or nothing to do with the older symbols, though these have occasionally been incorporated into its charges, and an apparent connection thus established between them. These symbols were the precursors and not the ancestors of heraldic bearings. The supposed connection, however, misled the credulous heraldic writers of the sixteenth and seventeenth centuries, and caused them to attribute coats of arms to the heroes of sacred and profane history, who were certainly as ignorant of heraldry as ever was Adam of genealogy.

"Arms" or "armories," so called because originally displayed upon defensive armor, and "coats of arms" because formerly embroidered upon the surcoat or camise worn over the armor, are supposed to have been first used at the great German tournaments, and to have reached England, though to a very moderate extent, in the time of Henry II. and Cœur de Lion. To "blazon," now meaning to describe a coat of arms, is the German "blasen," to blow as with the horn, because the style and arms of each knight were so proclaimed on public occasions. The terms employed in heraldry are, however, mostly French or of French origin. Though now matters of form and ceremonial, and subject to the smile which attaches to such in a utilitarian age, armorial bearings were once of real use and importance, and so continued as long as knights were cased in plate, and their features thus concealed. At that time leaders were recognized in the field by their insignia alone, and these — both figures and colors — became identified with their fame, from personal became hereditary, were subject to certain rules of descent, and to the laws of propriety and the less certain rules of honor.

It is uncertain at what period armorial bearings found their way into England. The Conqueror and his successors certainly did not use them; they do not appear upon their seals, nor are they shown upon the banners of the Bayeux tapestry. Stephen is said to have used a centaur, Sagittarius, as an emblem, because he landed in England when the sun was in that sign, but on his great seal his shield is quite plain, save a ridge down the center, evidently a part of its construction. On the seals of the Conqueror, Rufus, and Henry I., only the hollow or under side of the shield is shown; so there probably was no design upon the front.

No sooner had the great barons assumed arms for themselves than they began to grant them to their followers. Arms so granted commonly bore some resemblance to those of the grantor, and hence certain charges prevailed in certain districts.

The crusades, by bringing together soldiers of different nations, tended to produce a certain assimilation in their heraldries, but their influence upon the arms themselves has been exaggerated. The stories as to bearings adopted to commemorate feats of arms in Palestine are mostly inventions. The cross no doubt was a crusading bearing, but it was so because it was the emblem of Christianity, and primarily popular as such.

The diversions of the tournament did even more than actual war to promote the glories of heraldry. On these occasions the presence of spectators, and especially of ladies, encouraged all sorts of heraldic display. At a tournament at Calais in 1381 Richard Beauchamp, earl of Warwick, one of the most accomplished knights of the reigns of Richard II., Henry IV., and Henry V., suspended on three shields three several coats of arms, as representing three several knights who professed to be ready successively to meet all comers. Three French knights appeared to the challenge, and were defeated by Warwick, wearing alternately the three coats to which he was entitled.

The shield, as the most obvious piece of the defensive armor, was that upon which arms were first displayed. The Norman shield was of wood covered with hide, and clamped and stiffened in a fashion which is thought to have given rise to the first simple bearings. It was three to four feet long, pointed below, and eighteen inches broad. This shield is common on early monumental effigies armed in chain mail, and it is unusual to find it with armorial bearings. It was succeeded by the small triangular heater shield, and that, in the reign of Edward III., by a somewhat larger and full bottomed shield, which by degrees ceased to be used in war, and became more and more an architectural ornament. The arms were also displayed upon the breastplate, and upon the camise or surcoat that covered the armor, and were repeated upon the housings of horses both before and behind the saddle.

The importance attached to armorial bearings is strongly shown in the uses to which they were applied. A sovereign who wished to assert his claim to a kingdom placed its arms upon his shield. In 1479, when Alphonso of Portugal resigned his claim to Castile, he was required to lay aside his armorial ensigns. It appears that when Edward III. assumed the French lilies, he at first did so simply as representing his mother, who was an heiress, and placed her arms in his second quarter; when, however, he claimed the kingdom of France in her right, he removed the lilies to the first quarter as representing the more important kingdom. A grant of arms at the hand of a sovereign had great value.

As arms became hereditary, and their use ceased to be confined to the battle-field, but was largely extended to seals and ornaments, it was natural that some notice should be taken of the arms of females, and that the wife's coat should be combined in some way with that of the husband, especially when she was the last of, and represented, her family. This seems first to have been managed by giving the wife a separate shield. The kings of France so bore the arms of Navarre after the marriage with the heiress of that kingdom. Another very early plan was to form a composite coat.

As the combinations out of which the early coats were formed were limited, it occasionally happened that two persons of the same nation bore the same arms, and this gave rise to disputes which, as matters connected with military discipline, came under the jurisdiction of the earl marshal.

The same necessity that made it important to prevent the use of similar bearings by different families in the same country made it also necessary to distinguish between the bearings of different members of the same family, all of whom had a right to the paternal coat. As this right was strongest in the eldest son he alone bore the paternal arms unaltered (in French heraldry "*sans brisure*"); and the other sons were obliged to introduce some sufficient change, called in heraldry a "*difference*."

All these rules and alterations were, however, the

growth of a later age, and came into use as the bold and simple heraldry of the thirteenth and fourteenth centuries began to be overlaid with florid fancies. So long as heraldry represented a real want, its expressions were simple and intelligible, but as "*villainous saltpeter*" came into use and closed helmets were laid aside, and as skill and strategy, rather than personal valor, became the attribute of a leader, armorial bearings fell into disuse in war, and were no longer worn upon the person or upon the horse trappings. But though armorial bearings ceased to be of actual use, they continued to be emblems of rank and family, and a mark of gentle blood. They became, however, exceedingly and often absurdly complex, partly because simplicity was no longer necessary, and partly because it was scarcely practicable, owing to the enormous increase in the number of the gentry, which produced a demand for new combinations.

The glories of heraldry reached their zenith in the reign of Richard II., with "*youth at the prow and pleasure at the helm*" of the vessel of the state, but it was not till the reign of Richard III. that it was thought necessary to place under specific control the whole heraldry of the kingdom; and this, in close imitation of the example of France, was done by the incorporation of the heralds into a college, placed under the presidency of the earl marshal.

The office of the herald, as the messenger of war or peace between sovereigns, or between contending armies in the field, is of far earlier date than the introduction of armorial bearings, but as these came into use they were gradually placed under his charge, and he took his specific name sometimes from that of the noble or leader who employed him, sometimes from one of his castles or titles of honor, and sometimes from one of his badges or cognizances, which the herald wore embroidered upon his dress, and by which he was known.

A curious evidence of the vitality of heraldry, and of the desire of all mankind for ancestral distinctions, is afforded by its extension among the republics of the New World. The United States boasts some excellent genealogical societies, and a great and very general desire is shown by individuals to trace their pedigrees to the stocks of the Old World, and to assume the arms proper to their name. The national emblem of the stars and stripes, now so widely and honorably known throughout the world, has been traced back to the paternal coat of the first and greatest president, George Washington, whose English ancestors bore "*argent, two bars gules, in chief three mullets of the second*." In Canada, Australia, and other English colonies, the assumption of arms by individuals and by the community is not less general; and the republics of South America, of Spanish origin, almost all have adopted coats of arms. The Peak of Teneriffe, the Beaver, the Red Indian, contribute to the list of charges, and the clear firmament of Chili is indicated by a star. "*Coupé d'azur sur gules, à une étoile d'argent en abîme*."

HERAT is a city of great interest both historically and geographically, and is of even greater interest politically, its importance at the present day being indicated by its popular designation of the "*key of India*." Its origin is lost in antiquity. We can only infer, from the colossal character of the earthworks which surround the modern town, that, like the similar remains at Bost on the Helmand and at Ulán Robát of Arachosia, they belong to that period of Central-Asian history which preceded the rise of Achæmenian power, and which in Grecian romance is illustrated by the names of Bacchus, of Hercules, and of Semiramis.

The natural advantages of Herat are mainly due to its river, which, rising in the high uplands 350 miles to

the eastward, passes in the upper part of its course through a succession of rolling downs of the finest pasture-land, and lower down traverses a more contracted valley, enlivened, however, throughout with smiling villages and orchards, till it reaches the eastern limit of the alluvial plain of Herat. Here at the present day nine large canals (in former times there were twenty) carry off the waters of the Heri-rúd for the irrigation of the circumjacent plain, which on a rough calculation may be said to contain nearly 400 square miles of land available for cultivation.

The city of Herat is very centrally situated, great lines of communication radiating from it in all directions—southward to Seistan (200 miles), southeastward to Kandahar (370 miles), eastward to Cabul (550 miles), northward by Mymeneh to Bokhara (600 miles), and by Merv to Khiva (700 miles), while to the westward four routes lead into Persia by Turbat to Meshed (215 miles), and by Birjend to Kermán (400 miles), to Yezd (500 miles), or to Ispahán (600 miles). The city forms a quadrangle of nearly a mile square (more accurately about 1,600 yards by 1,500 yards); on the western, southern and eastern faces the line of defense is almost straight, the only projecting points being the gateways, but on the northern face the contour is broken by a double outwork, consisting of the *Ark* or citadel, which is built of sun-dried brick on a high artificial mound within the enceinte, and a lower work at its foot, called the *Ark-i-now*, or “new citadel,” which extends 100 yards beyond the line of the city wall. That which distinguishes Herat from all other Oriental cities, and at the same time constitutes its main defense, is the stupendous character of the earthwork upon which the city wall is built. This earthwork averages 250 feet in width at the base and about fifty feet in height, and as it is crowned by a wall twenty-five feet high and fourteen feet thick at the base, supported by about 150 semicircular towers, and is further protected by a ditch forty-five feet in width and sixteen in depth, it presents an appearance of imposing strength. Whether the place is really as strong as it looks has been differently estimated. General Ferrier, who resided for some time in Herat, states that the city is nothing more than an immense redoubt, and gives it as his opinion that as the line of wall is entirely without flanking defenses, the place could not hold out for twenty days against a European army; and M. Khanikoff, who, though not a professional soldier, was a very acute observer, further remarks that the whole interior of the city is dominated from the rising ground at the northeast angle, while the water supply both for the ditch and the city would be at the mercy of an enemy holding the outside country, the wells and reservoirs inside the wall, which would then be alone available, being quite inadequate to the wants of the inhabitants; but on the other hand all experience testifies to the defensibility of the position. Not to speak of the sieges which Herat sustained at the hands of Jenghiz Khan, of Timur, and of Ahmed Shah, we have only to remember that in 1837 the Afghans of Herat beat off the continuous attack for nearly ten months of a Persian army of 35,000 regular troops, supported by fifty pieces of artillery, and in many cases directed and even commanded by Russian officers. The truth seems to be that Herat, though in its present state quite unfit to resist a European army, possesses great capabilities of defense, and might by a skillful adaption of the resources of modern science be made almost impregnable.

The city possesses five gates, two on the northern face, the Kutab-chak near the northeast angle of the wall, and the Malik at the reëntering angle of the *Ark-i-now*; and three others in the centers of the remaining faces, the Irák gate on the west, the Kandahar gate on

the south, and the Khushk gate on the east face. Four streets called the *Chahar-súk*, and running from the center of each face, meet in the center of the town in a small domed quadrangle. The principal street runs from the south or Kandahar gate to the market in front of the citadel, and is covered in with a vaulted roof through its entire length, the shops and buildings of this bazaar being much superior to those of the other streets, and the merchants' caravanserais, several of which are spacious and well built, all opening out on this great thoroughfare. Near the central quadrangle of the city is a vast reservoir of water, the dome of which is of bold and excellent proportions. It is stated by General Ferrier to have been constructed by command of Shah Abbas, and to be a *chef d'œuvre* of its kind. It is supposed to contain above a twelve months' supply of water for the entire city, but, as M. Khanikoff observes, it is within easy mortar range of the high ground at the northeast angle of the city, and might thus be destroyed by a few well-directed shells, in which case the ruins of the dome would fill up the basin and the water supply would be lost. The only other public building of any consequence in Herat is the great mosque or *Mesjid-i-juma*, which comprises an area of 800 yards square, and must have been a most magnificent structure. At the present day, with the exception of the *Chahar-súk*, where there is always a certain amount of traffic, and where the great diversity of race and costume imparts much liveliness to the scene, Herat presents a very melancholy and desolate appearance. The mud houses in rear of the bazaars are for the most part uninhabited and in ruins, and even the burned brick buildings are becoming everywhere dilapidated. The city is besides one of the filthiest in the East, as there are no means of drainage or sewerage, and garbage of every description lies in heaps in the open streets. Since 1863 Herat has been a provincial city governed from Cabul, and its average population has ranged between 20,000 and 30,000, within which limits must be confined its present estimate.

In actual territory the province of Herat extends east and west from near the sources of the Heri-rúd about 300 miles to the Persian frontier beyond Ghorian, and north and south from the Merv boundary, in about 36° latitude, 200 miles to the northern limit of Seistan. The inhabitants of the city of Herat are for the most part Shiah, and in regard to language and habits, as well as religion, are Persians rather than Afghans. There are, however, both in the town and in the neighboring villages a certain number of Afghan colonists, who have been settled there—the greater part by Nadir Shah—during the last 150 years, as well as Hazáreh, Jamshídís and Taimenis, with a fair sprinkling of Hindus and some forty families of Jews. The net revenue of the valley and its immediate dependencies in ordinary times is under £100,000 per annum, but the vizier Yar Mahomed Khan is supposed in the plenitude of his power, and when he had for a time brought a great part of Seistan under his sway, to have realized double that amount from the entire province.

To trace in any detail the fortunes of Herat would be to write the modern history of the East, for there has hardly been a dynasty revolution, or a foreign invasion, or a great civil war in Central Asia since the time of the Prophet, in which Herat has not played a conspicuous part and suffered accordingly. Under the Tahirides of Khorassan, the Soffarians of Seistan, and the Samanides of Bokhara, it flourished for some centuries in peace and progressive prosperity; but during the succeeding rule of the Ghaznevide kings its metropolitan character was for a time obscured by the celebrity of the neighboring capital of Ghazni, until finally in the reign of

Sultan Sanjar of Merv about 1157 the city was entirely destroyed by an irruption of the Ghos, the predecessors, in race as well as in habitat, of the modern Turcomans. Herat gradually recovered under the enlightened Ghoride kings. But the Moghul visitation was most calamitous; forty persons, indeed, are stated to have alone survived the general massacre of 1232, and as a similar catastrophe overtook the city at the hands of Timur in 1398, it is astonishing to find that early in the fifteenth century Herat was again flourishing and populous, and the favored seat of the art and literature of the East. It was, indeed, under the princes of the house of Timur that most of the noble buildings were erected, of which the remains still excite our admiration at Herat. Four times was Herat sacked by Turcomans and Uzbeks during the centuries which intervened between the Timuride princes and the rise of the Afghan power, and it has never in modern times attained to anything like its old importance. It will be needless to trace the revolutions and counter-revolutions which have followed each other in quick succession at Herat since Ahmed Shah Duráni founded the Afghan monarchy about the middle of the last century. Let it suffice to say that Herat has been throughout the seat of Afghan government, sometimes in subordination to Cabul, and sometimes independent. Persia, indeed, for many years showed a strong disposition to reassert the supremacy over Herat, which was exercised by the Suffavean kings, but Great Britain, disapproving of the advance of Persia toward the Indian frontier, steadily resisted the encroachment; and, indeed, after helping the Herátis to beat off the attack of the Persian army in 1838, the British at length compelled the Shah in 1857 at the close of his war with them to sign a treaty recognizing the future independence of the place, and pledging Persia against any further interference with the Afghans. In 1863 Herat, which for fifty years previously had been independent of Cabul, was incorporated by Dost Mahomed Kahn in the Afghan monarchy, but he died there June 9, 1863, and was succeeded by his son, Shere Ali Khan. The latter, after much fighting, during which at one time (1867) he held only Balkh and Herat, made his power solid over Afghanistan. In 1878-79 Lord Lytton, then governor-general of India, picked a quarrel with Shere Ali, and sent an army to Kandahar; Shere Ali fled to Russian territory, and died there February 20, 1879. His son and successor, Yakub Khan, made a treaty with the English at Gundamak, by which England secured the Khybar Pass and the right to maintain a permanent embassy in Cabul. Maj. Louis Cavagnari entered Cabul as ambassador in July, and was slain in the streets a month later. Herat fell into the hands of the war party, and the English, under General Roberts, made another advance into Cabul. Yakub Kahn was arrested and deposed; the British occupied Kandahar and proclaimed Shere Ali prince of that district. Ayub Khan defeated the English forces under the walls of Kandahar July 26th, but was in turn defeated by Roberts a month later. Owing to the overthrow of the Beaconsfield ministry in England, and the accession of the Liberals to power, the plans were changed, and the British instead of holding the fortified places proclaimed Abdur-Rahman Kahn, son of Dost Mahomed, as emir of Afghanistan, and evacuated the country in the summer of 1881. Ayub Khan raised an army with the help of Russia, and again took Kandahar in July, 1881, but the reigning emir retook the city, and on October 13th captured Herat and ended the war. Abder-Rahman now reigns over the same country as was governed by his grandfather.

HÉRAULT, a department in the south of France,

formed from parts of the old province of Languedoc, is bounded on the northeast by Gard, northwest by Aveyron and Tarn, and south by Aude and the Gulf of Lyons. It has an area of 2,444 square miles, and a population of nearly half a million. Its greatest length is eighty-four miles, and its greatest breadth fifty. About a third of the department consists of moorland, heath, and common, a fourth of arable land, a sixth of vineyards, and an eighth of wood. The southern prolongation of the Cevennes mountains forms the north boundary of the department. The highest point is about 4,250 feet above the sea-level. The ridge forms the watershed between the waters of the Atlantic and the Mediterranean, and from it there flow the Vidourle, Mosson, Hérault, Livron, and Orb. The department has Montpellier for its capital, and is divided into the arrondissements of Montpellier, Béziers, Lodève, and St. Pons, with thirty-six cantons and three hundred and thirty-one communes.

HERBARIUM, or HORTUS SICCUS, a collection of plants so dried and preserved as fully to illustrate their several specific characters. Since the same plant, owing to peculiarities of climate, soil, and situation, degree of exposure to light, and other influences, may vary greatly according to the locality in which it occurs, it is only by gathering together for comparison and study a large series of examples of each species illustrative of the flora of different regions that the laws of vegetable morphology, and many more points of scientific interest, can be satisfactorily determined. Thus, from the herbarium may be acquired a knowledge of those details concerning the minuter structure of individual plants which are of necessity omitted in works of systematic botany, as also of the relative taxonomic importance of the characters to be met with in large groups of forms.

The collection of the Royal Herbarium at Kew, generally acknowledged to be at once the most extensive and the best preserved and most orderly in the world, comprises some 100,000 species, many of them represented by numerous specimens. It is arranged, for easy reference, in cases situate between the windows of the building containing it, the atmosphere of which is kept dry by means of hot-water pipes. In the intervening spaces are tables for the purpose of study, which is further facilitated by the presence in the same building of a large and valuable botanical library. Next in importance is the herbarium of the British Museum, which comprises assemblages of specimens gathered by numerous eminent botanists. The collection of Dillenius is deposited at Oxford, and that of the late Professor Harvey at Trinity College, Dublin. The original herbarium of Linnæus is in the possession of the Linnean Society of London. With the more important British herbaria are to be ranked also those of Cambridge and Edinburgh. The collections of Jussieu and St. Hilaire are included in the large herbarium of the Jardin des Plantes at Paris, and in the same city is the extensive private collection of Doctor Cosson. At Geneva are three large collections. The university of Göttingen has had bequeathed to it the largest collection (exceeding 40,000 specimens) ever made by a single individual—that of the late Professor Grisebach. At the herbarium in Brussels are the specimens obtained by the traveler Martius. Other national herbaria sufficiently extensive to subserve the requirements of the systematic botanist exist at Berlin, St Petersburg, Vienna, Leyden, Stockholm, Upsala, Copenhagen, and Florence. Of those in the United States of America, the chief, formed by Asa Gray, is the property of Harvard university; others are to be seen at Yale and Columbia colleges and at New York and Michigan universities. The herbarium at

Melbourne, Australia, under Baron Müller, has attained large proportions; and that of the Botanical Garden of Calcutta is noteworthy as the repository of numerous specimens described by writers on Indian botany.

HERBART, JOHANN FRIEDRICH, was born at Oldenburg in 1776. He showed his bent toward philosophy while still a child, and after studying under Fichte at Jena gave his first philosophical lectures at Göttingen in 1805, whence he removed in 1809 to occupy the chair formerly held by Kant at Königsberg. Here he also established and conducted a seminary of pedagogy till 1833, when he returned once more to Göttingen, and remained there as professor of philosophy till his death in 1841.

HERBELOT, BARTHÉLEMY D', Orientalist, was born December 4, 1625, at Paris. He devoted himself to the study of the Oriental languages, and went to Italy to perfect himself in them by converse with the Orientals who frequented its seaports. There he made the acquaintance of his fellow-savants, Lucas Holstenius and Leo Allatius, and attracted the favorable notice of the cardinals, Grimaldi and Bamberini. On his return to France after a year and a half, he was received into the house of Fouquet, superintendent of finance, who gave him a pension of 1,500 livres. In 1661, he was appointed secretary and interpreter of Eastern languages to the king. A few years later he again visited Italy, when the grand-duke Ferdinand II. of Tuscany presented him with a large number of valuable Oriental MSS., and tried to attach him to his court. Herbelot, however, was recalled to France by Colbert, and in 1692 succeeded D'Auvergne in the chair of Syriac, in the Collège de France. He died at Paris, December 8, 1695. His great work is the *Bibliothèque Orientale*, which occupied him nearly all his life, and was published in 1697 by Galland.

HERBERT, GEORGE, one of the best of English religious poets, was born near the town of Montgomery on April 3, 1593. He was a brother of Lord Herbert of Cherbury, noticed below. Educated privately till the age of twelve, he was then sent to Westminster School, and in 1608 he became a student at Trinity College, Cambridge, where he was made B.A. in 1611, M.A. and major fellow of the college in 1615, and orator for the university in 1619. In his capacity as orator he was several times brought into contact with King James. He numbered among his friends Doctor Donne, Sir Henry Wotton, Izaak Walton, Bishop Andrewes, and Francis Bacon, who consulted Herbert about several of his works, and dedicated to him his translation of the Psalms. During his youth he was a courtier. In July, 1626, he was appointed prebendary of Layton Ecclesia, in the county of Huntingdon. The story of the poet's life at Bamerton, as told by Walton, is one of the most exquisite pictures in literary biography. He devoted much time to explaining the meaning of the various parts of the Prayer-Book, and held services twice every day, at which many of the parishioners attended, and some "let their plough rest when Mr. Herbert's saint's-bell rung to praise, that they might also offer their devotion to God with him." Next to Christianity itself he loved the English Church. He was passionately fond of music, and usually went twice a week to attend the cathedral service at Salisbury. He died in 1633.

HERBERT, HENRY WILLIAM, novelist and writer on sports, son of Hon. and Rev. William Herbert, dean of Manchester, a son of the first earl of Carnarvon, was born in London, April 7, 1807. He was educated at Eton and at Caius College, Cambridge, where he graduated M.A. in 1828. He emigrated to America, and from 1831 to 1839 was teacher of Greek

in a private school in New York. In 1833 he commenced the *American Monthly Magazine*, which he edited till 1835. In 1834 he published his first novel, *The Brothers, a Tale of the Fronde*, which was followed by a number of others, all of them obtaining a certain degree of popularity. He was also successful in a series of historical studies, such as *The Cavaliers of England*, *The Knights of England, France, and Scotland*, *The Chevaliers of France*, and *The Captains of the Old World*, and wrote numerous contributions to magazines; but he is best known for his works on sporting, published by him under the pseudonym of Frank Forester. These include *The Field Sports of the United States and British Provinces* (1849), *Frank Forester and his Friends* (1849), *The Fish and Fishing of the United States* (1850), *The Young Sportsman's Complete Manual*, and *The Horse and Horsemanship in the United States and British Provinces of North America* (1858). Herbert was a man of varied accomplishments. He died by his own hand at New York, May 17, 1858.

HERBERT, SIR THOMAS, traveler and author, was born at York in 1606, and died in 1682.

HERBERT, LORD, OF CHERBURY. Edward Herbert, soldier, diplomatist, historian, and religious philosopher, was born at Eyton, in Shropshire, in 1582, and was descended from an ancient line of illustrious soldiers, to which the earls of Pembroke belonged. Sent to Oxford in his twelfth year, he married an heiress, his kinswoman, in his fifteenth, and returned to the university to prosecute his "beloved studies." He was knighted soon after the accession of James I., and for a year or two fulfilled the functions of sheriff of his county. In 1608 he went abroad, at Paris gaining the esteem and love of the old Constable de Montmorency, and beginning an acquaintance with scholars like Casaubon, Gassendi, and Grotius. Next year he served as a volunteer in the Low Countries under the prince of Orange, whose intimate friend he became, and also took part in the campaigns of 1614 and 1615. Between the latter campaigns he visited Italy, and on his return was arrested in France for recruiting Huguenots for the service of the duke of Savoy. In 1618 he was sent as ambassador extraordinary to the court of France; and, though recalled for a few months through the hostility of the French king's favorite, he soon returned to Paris as ordinary ambassador. In 1625 he came back to England, where, with the exception of one or more visits to Paris, he spent the rest of his life. He died August 20, 1648.

HERBS, or HERBACEOUS PLANTS, in botany, are those in which no persistent woody stem is formed above ground. In some, the stem is woody but still annual. There is, however, in many, a permanent woody *rhizome* or root-stock. In books of gardening, plants used only for flavoring are sometimes distinguished as *sweet herbs*, as mint, basil, etc.; while those valued for their nutritive qualities are known as *pot herbs*.

HERCULANEUM. The ruins of the buried city of Herculaneum are situated about two-thirds of a mile from the Portici station of the railway from Naples to Pompeii. They are less frequently visited than the ruins of the latter city, not only because they are smaller in extent and of less obvious interest, but also because they are more difficult of access. The small part of the city which has been restored to the light of day in the spot called *the new excavations*, was discovered in the present century. But the more important works were executed in the last century; and of the buildings then explored at a great depth, by means of tunnels, none are visible except the theater, the orchestra of which lies eighty-five feet below the surface of the soil.

The brief notices of the classical writers inform us that Herculaneum was a small city of Campania, between Neapolis and Pompeii, that it was situated between two streams at the foot of Vesuvius, on a hill overlooking the sea, and that its harbor was at all seasons safe. With regard to its earlier history nothing is known. It enjoyed great prosperity toward the close of the republic and in the earlier times of the empire, since many noble families of Rome settled this pleasant spot for the construction of splendid villas, one of which indeed belonged to the imperial house. In the year 63 A.D., it suffered terribly from an earthquake. Hardly had it completed the restoration of some of its principal buildings when it fell beneath the great eruption of the year 79, described by Pliny the younger, in which Pompeii also was destroyed with other flourishing cities of Campania. According to the commonest account, on August 23d of that year, Pliny the elder, who had command of the Roman fleet at Misenum, set out to render assistance to the soldiers stationed at Retina, near Herculaneum, as there was no escape except by sea, but the little harbor having been on a sudden filled up so as to be inaccessible, he was obliged to abandon to their fate those people of Herculaneum and Retina who had managed to flee from their houses, overwhelmed in a moment by the material poured forth by Vesuvius. But the text of Pliny the younger, where this account is given, has been subjected to various interpretations; and from the comparison of other classical testimonies and the study of the excavations it has been concluded that it is impossible to determine the date of the catastrophe. The opinion that immediately after the first outbreak of Vesuvius a torrent of lava was ejected over Herculaneum was refuted by the scholars of the last century, and their refutation has been recently confirmed by Beulé. From Torre Annunziata (which is believed to be the site of the ancient Oplontii) to San Giovanni a Teduccio, for a distance of about nine miles, there flowed a muddy eruption which in Herculaneum and the neighboring places, where it was most abundant, raised the level of the country more than sixty-five feet. The matter transported consisted of soil of various kinds,—sands, ashes, fragments of lava, pozzolana, and whitish pumice, inclosing grains of uncalcined lime, similar in every respect to those of Pompeii. In the part of Herculaneum already excavated, the corridors in the upper portions of the theater are compactly filled, up to the head of the arches, with pozzolana and pumice transformed into tuff (which proves that the formation of this stone may take place in a comparatively short time). Tuff is also found in the lowest part of the city toward the sea in front of the few houses that have been discovered; and in the very high banks that surround them, as also in the lowest part of the theater, there are plainly to be seen earth, sand, ashes, fragments of lava and pumice, with little distinction of strata, almost always confused and mingled together, and varying from spot to spot in degree of compactness. It is clear that this immense congeries of earth and stones could not flow in a dry state over those five miles of country (in the beginning very steep, and at intervals almost level), where certainly it would have been arrested and all accumulated in a mound; but it must have been borne along by a great quantity of water, the effects of which may be distinctly recognized, not only in the filling and choking up even of the most narrow, intricate, and remote parts of the buildings, but also in the formation of the tuff, in which water has so great a share; for it cannot be supposed that enough of it has filtered through so great a depth of earth. The torrent ran in a few hours to the sea, and formed that shallow or

lagoon called by Pliny *Subitum Vadum*, which prevented the ships approaching the shores. Hence it is that, while many made their escape from Pompeii (which was overwhelmed by the fall of the small stones and afterward by the rain of ashes), comparatively few can have managed to escape from Herculaneum, and these, according to the interpretation given to the inscription preserved in the National Museum, found shelter in the neighboring city of Neapolis, where they inhabited a quarter called that of the buried city. The name of Herculaneum, which for some time remained attached to the site of the disaster, is mentioned in the later itineraries; but in the course of the Middle Ages all recollection of it perished.

In 1709, while Prince Elbeuf of the house of Lorraine, in command of the armies of Charles VI., was seeking crushed marble to make plaster for his new villa near Portici, he learned from the peasants that there were in the vicinity some pits from which they not only quarried excellent marble, but had extracted many statues in the course of years (see Jorio, *Notizia degli scavi d'Ercolano*, Naples, 1827). In 1738, while Col. D. Rocco de Alcubierre was directing the works for the construction of the *Real Delizie* at Portici, he received orders from Charles III. to begin excavations on the spot where it had been reported to the king that the Elbeuf statues had been found. At first it was believed that a temple was being explored, but afterward the inscriptions proved that the building was a theater. This discovery excited the greatest commotion among the scholars of all nations; and many of them hastened to Naples to see the marvelous statues of the Balbi and the paintings on the walls. But everything was kept private as the government wished to reserve to itself the right of illustrating the monuments. The antiquities excavated at Herculaneum in the last century form a collection of the highest scientific and artistic value. There are marble statues of astonishing art and perfect preservation, of which it is sufficient to mention the two equestrian statues of the Balbi (*Museo Borbonico*, vol. ii., pl. xxxviii.–ix.) and the so-called statue of Aristocles. With the exception of a few pieces, nearly all the great bronzes of the museum belong to Herculaneum. It is thence that we have obtained the reposing Hermes, the drunken Silenus, the sleeping Faunus, the dancing girls, the bust called Plato's, that believed to be Seneca's, the two quoit-throwers or discoboli, and so many masterpieces more, figured by the academicians in their volume on the bronzes. Mural paintings of extraordinary beauty were also discovered, such as those that represent Theseus after the slaughter of the Minotaur, and Chiron teaching Achilles the art of playing on the lyre.

HERCULES (Old Latin, *Hercoles*, *Hercles*) is the Latinized form of the mythical Heracles, the chief national hero of Hellas, who has part in all the most important myths of the generation before that which embraces the Homeric warriors at Troy. The name Heracles is compounded of *Hera*, the goddess, and the stem of *Cleos*, "glory." The thoroughly national character of Heracles is shown by his being the mythical ancestor of the Dorian dynastic tribe, while revered by Ionian Athens, Lelegian Opus, and Æolo-Phœnician Thebes, and closely associated with the Achæan heroes Peleus and Telamon. The Perseid Alcmena, wife of Amphitryon of Tiryns, was Hercules' mother, Zeus his father (see *ALCMENE*). After his putative father he is often called Amphitryoniades, and Alcides too, after the Perseid Alcæus, father of Amphitryon. His mother and her husband lived at Thebes in exile as guests of King Creon. By the craft of Hera, his foe through life, his birth was delayed, and that of Eurystheus, son of

Sthenelus of Argos, hastened, Zeus having in effect sworn that the elder of the two should rule the realm of Perseus. Hera sent two serpents to destroy the newborn Hercules, but he strangled them. He was trained in all manly accomplishments by heroes of the highest renown in each, until he slew Linus, his instructor in music, with the lyre. Thereupon he was sent to tend Amphitryon's oxen, and at this period slew the lion of Mount Cithæron. By the subjection of the Minyans of Orchomenus he won Creon's daughter, Megara, to wife. Her children by him he killed in a frenzy induced by Hera. After purification he was sent by the Pythia to serve Eurystheus. The apologue of Prodicus on the *Choice of Hercules* between pleasure and virtue was founded on his obedience to the oracle. Thus began the cycle of the twelve labors:

1. Wrestling with the Nemean lion.
2. Destruction of the Lernean hydra.
3. Capture of the Arcadian hind (a stag in art).
4. Capture of the boar of Erymanthus, while chasing which he fought the Centaurs and killed his friends Chiron and Pholus, this homicide leading to Demeter's institution of *mysterics*.
5. Cleansing of the stables of Augeas.
6. Shooting the Stymphalian birds.
7. Capture of the Cretan bull subsequently slain by Theseus at Marathon.
8. Capture of the man-eating mares of the Thracian Diomedes.
9. Seizure of the girdle of Hippolyte, queen of the Amazons.
10. Bringing the oxen of Geryones from Erythia in the far west, which errand involved many adventures in the coast lands of the Mediterranean, and the setting up of the "Pillars of Hercules" at the Straits of Gibraltar.
11. Bringing the golden apples from the garden of the Hesperides.
12. Carrying Cerberus from Hades to the upper world.

On Hercules' return to Thebes he gave his wife Megara to his friend and charioteer Iolaus, son of Iphicles, and by beating Eurytus of Œchalia and his sons in a shooting match won a claim to the hand of his daughter Iole, whose family, however, except her brother Iphitus, withheld their consent to the union. Iphitus persuaded Hercules to search for Eurytus' lost oxen, but was killed by him at Tiryns in a frenzy. He consulted the Pythia about a cure for the consequent madness, but she declined to answer him. Whereupon he seized the oracular tripod, and so entered upon a contest with Apollo, which Zeus stopped by sending a flash of lightning between the combatants. The Pythia then sent him to serve the Lydian queen Omphale. He then, with Telamon, Peleus, and Theseus, took Troy. He next helped the gods in the great battle against the giants. He took part in the Argonautic voyage and the Calydonian boar hunt, made war against Augeas, and against Nestor and the Pylans, and restored Tyndareus to the sovereignty of Lacedæmon. He sustained many single combats, one very famous struggle being the wrestling with the Libyan Antæus, son of Poseidon and Ge (Earth), who had to be held in the air, as he grew stronger every time he touched his mother, Earth. Hercules withstood Ares, Poseidon, and Hera, as well as Apollo. The close of his career is assigned to Ætolia and Trachis. He wrestles with Achelous for Deianeira ("destructive to husband"), daughter of Œneus, king of Calydon, vanquishes the river god, and breaks off one of his horns, which as a horn of plenty is found as an attribute of Hercules in art. Driven from Calydon for homicide, he goes with Deianeira to Trachis. On the way he slays the centaur Nessus, who persuades Deianeira that his blood is a love-charm. From Trachis he wages successful war against the Dryopes and Lapithæ as ally of Ægimius king of the Dorians, who promised him a third of his realm, and after his death adopted Hyllus, his son by Deianeira. Finally Hercules attacks Eurytus, takes Œchalia, and carries off Iole. Thereupon Deianeira, prompted by love and jealousy, sends

him a tunic dipped in the blood of Nessus, and the unsuspecting hero puts it on just before sacrificing at the headland of Cenæam in Eubœa. Mad with pain, he seizes Lichas, the messenger who had brought the fatal garment, and hurls him on the rocks; and then he wanders in agony to Mount Ceta, where he mounts a pyre, which, however, no one will kindle. At last Pœas, father of Philoctetes, takes pity on him, and is rewarded with the gift of his bow and arrows. The immortal part of Hercules passes to Olympus, where he is reconciled to Hera and weds her daughter Hebe.

HERDER, JOHANN GOTTFRIED VON, one of the most prolific writers that Germany has produced, was born in Mohrungen, a small town near Königsberg, in 1744. Like his contemporary Lessing, with whose literary aims his own had so much in common, Herder had throughout his life to struggle against adverse circumstances. In 1762, at the age of eighteen, he went to Königsberg with the intention of studying medicine, but finding himself unequal to the operations of the dissecting-room, he abandoned this object, and by the help of one or two friends and his own self-supporting labors, followed out his earlier idea of the clerical profession by joining the university. There he came under the influence of Kant, who was just then passing from physical to metaphysical problems. Without becoming a disciple of Kant, the young Herder was deeply stimulated to fresh critical inquiry by that thinker's revolutionary ideas in philosophy. To Kant's lectures and conversations he further owed something of his large interest in cosmological and anthropological problems. Among the writers whom he most carefully read were Plato, Hume, Shaftesbury, Leibnitz, Diderot, and Rousseau. Another personal influence under which he fell at Königsberg, and which was designed to be far more permanent, was that of Hamann, the "northern Mage." Soon after this he got a double appointment at Riga, as assistant master at the cathedral school, and as curate to the suburban churches. In this busy commercial town, in somewhat improved pecuniary and social circumstances, he developed the main ideas of his writings. In the year 1767 he published his first considerable work, *Fragmente über die neuere deutsche Literatur*, which at once made him widely known and secured for him the favorable interest of Lessing. From this time he continued to pour forth a number of critical writings on literature, art, etc. He was much carried away at this time by the idea of a radical reform of social life in Livonia, which (after the example of Rousseau) he thought to effect by means of a better method of school-training. With this plan in view he began (1769) a tour through France, England, Holland, etc., for the purpose of collecting information respecting their systems of education. His new duties led him to Strasburg, where he met the young Goethe, on whose poetical development he exercised so potent an influence. At Darmstadt he made the acquaintance of Caroline Flachsland, to whom he soon became betrothed, and who for the rest of his life supplied him with that abundance of consolatory sympathy which his sensitive and rather querulous nature appeared to require. The engagement as tutor did not approve an agreeable one, and he soon threw it up (1771) in favor of an appointment as court preacher and member of the consistory at Bückeburg. For some time he had been greatly interested by the poetry of the north, more particularly Percy's *Reliques*, the poems of "Ossian" (in the genuineness of which he like many others believed), and the works of Shakespeare. Under the influence of this reading he now finally broke with classicism and became the leader of the new "Sturm und Drang" movement. He coöperated with a band of young writers at Darmstadt and Frankfort, including

Goethe, who in a journal of their own sought to diffuse the new ideas of Herder. His marriage took place in 1773. In 1776 he obtained through Goethe's influence the post of upper court preacher and upper member of the consistory at Weimar, where he passed the rest of his life. There he enjoyed the society of Goethe, Wieland, Jean Paul (who came to Weimar in order to be near Herder), and others; the patronage of the court, with whom as a preacher he was very popular, and an opportunity of carrying out some of his pet ideas of school reform. Yet the social atmosphere of the place did not suit him. His personal relations with Goethe again and again became embittered. While during the last years of his life he produced much that is of little value, he wrote also some of his best works, among others his collection of popular poetry, *Stimmen der Völker*; his most notable original poem, the *Cid*; his celebrated work on Hebrew poetry, *Vom Geist der hebräischen Poesie*; and his *opus magnum*, the *Ideen zur Philosophie der Geschichte*. Toward the close of his life he occupied himself like Lessing with speculative questions in philosophy and theology. The boldness of some of his ideas cost him some valuable friendships, as that of Jacobi, Lavater, and even his early teacher Hamann. He died in the year 1803, full of new literary plans to the very last.

HEREFORD, an inland English county on the south Welsh border, is bounded on the north by Salop, south by Monmouthshire and Gloucestershire, east by Worcestershire, and west by Radnorshire and Brecknockshire. Its circular shape is indented by spurs of adjacent counties, and its outlying parts have been incorporated with the counties in which they are situated. Its greatest length from Ludford by Ludlow to the Down Hills, near Monmouth, is thirty-eight miles; its greatest breadth from Cradley to Clifford, near Hay, thirty-five. Its area according to the census of 1871 is 532,898 statute acres, or 832 square miles. It is divided into eleven hundreds and 221 parishes, and is a bishop's see, of which the cathedral city is the center of the county. Population, 140,000.

HEREFORD, the capital city of the above county, is situated on the left bank of the Wye, which is crossed there by a bridge of six arches. The see of Hereford was detached from Lichfield in 673, Putta being its first bishop. The city was incorporated in 1189 by Richard I., and is governed by a municipal council, consisting of a mayor, six aldermen, and eighteen councilors. It has no manufactures. Its population is about 20,000.

HERENCIA, a town of Spain in the province of Ciudad Real, New Castile, is situated in a fertile, hilly region, near the junction of the rivers Giguera and Valdeespino, about eighty miles south of Madrid. Population (1890), 8,000.

HEREROLAND, or DAMARALAND, a region of Southwestern Africa, stretching north from the Kuisip to the Cunene, so called from the native race known to the Namaqua as Herero and to the Cape colonists as Damara (Damra, or Dama). The northwest portion is also known as Kaokoland. The population is about 120,000.

HERESY is the English equivalent of the Greek word, which has had a somewhat varied ecclesiastical use. The first employment of the word in the New Testament is to denote a sect or school of opinion among the Jews. We read of the heresy of the Sadducees, the heresy of the Pharisees, and St. Paul speaking to Agrippa says, "After the strictest heresy of our religion I lived a Pharisee." Christianity itself was in the beginning looked upon as one of those sects or schools of Jewish opinion, and the "heresy" of the Nazarenes is spoken of as well as the heresy of the

Pharisees. This use of the term is plainly borrowed from classical Greek, where *αἵρεσις* frequently means a school of Roman jurists or a school of philosophy. In the New Testament the word is used in another sense which is purely ecclesiastical. Thus in Titus iii. 10 the apostle says: "A man who is an *heretic* after the first and second admonition reject;" in 2 Pet. ii. 1 the church is warned against false teachers, "who privily shall bring in damnable *heresies*, even denying the Lord that bought them," and these heretics and false teachers are evidently the same as those of whom Paul, in the Epistle to the Galatians, says that they are to be anathematized. They are men who in the name of Christ preach such doctrines as tend to frustrate the grace of Christ, who preach "another gospel;" they are compared to the false prophets of the Old Testament Scriptures; they cause divisions and schisms in the church; and the heresies they are guilty of are classed along with grave moral offenses. It is this second New Testament use of the word which was taken over into ecclesiastical terminology, and it is in this sense that the early Christian writers speak of heresy and heretics. This early ecclesiastical use has continued down to the present, save that in earlier times schism was generally included under heresy, the names and the things not being separated by definition.

Heresy means a grave error in matters of faith, but it is much more than a theological or ecclesiastical term. From the days of the emperor Theodosius at the latest, the Christian religion has been intimately connected with law, and heresy is a legal term, with a definite meaning attaching to it; a heresy was a crime with punishment annexed, and therefore was capable of legal definition. It was an offense in canon law, and it was also for long an offense according to civil law.

The Theological Sense of the Term.—The early Christian writers say a great deal about heresy, but commonly refrain from telling what it is. They describe heresies, but they only denounce heresy. It is vain to look for a definition of it in Irenæus' *Against Heresies*, in Hippolytus' *Refutation of all Heresies*, in Tertullian's *Prescription against Heretics*. It is possible, indeed, to collect from these one or two leading tests of heresy, but no definition is to be found. The common features of heresy are too well known to call for specific enumeration. We can gather from Irenæus that heretics are those who reject Scripture, who refuse to accept the "doctrina tradita," who deny the authority of the clergy who have come in regular succession from the apostles, who keep aloof from the Catholic Church, the sole depositary of apostolic doctrine. Tertullian, in his usual succinct manner, calls every man a heretic who does not at once accept the "Regula Fidei," and he refuses to argue with such a man even though the heretic proceeds to adduce arguments from Scripture. In the Eastern Church, after the period of the œcumenical councils, Tertullian's test was the touchstone of heresy. The church had her rule of faith expanded into the Nicæo-Constantinopolitan creed, with the various explanations added in the symbols of the remaining œcumenical councils, and a heretic was one who denied this creed in whole or in part. In the Western Church, on the other hand, theologians were accustomed to define heresy in a vague way. Thus Jerome calls heresy "perversum dogma;" a heretic, with him, is one who interprets Scripture in other fashion than according to the witness of the Spirit of God; and Augustine summarily defines heresy to be the invention or retention of new and false opinions. But whatever the definition, the rough and ready test was always nonconformity to the "formula fidei præscripta ab ecclesia Romana." Instead of

definition the Eastern Church simply points to the creed and the œcumenical councils; the Western Church to the rule of faith enjoined by Rome.

HERFORD, a town of Prussia, capital of a circle in the government district of Minden, province of Westphalia; is situated in a beautiful and fruitful district at the confluence of the Werra and Aa, and on the Minden and Cologne railway, nineteen miles southwest of Minden. Population, 12,000.

HERIOT. See **COPYHOLD**.

HERIOT, GEORGE (1563-1623), the founder of Heriot's Hospital, Edinburgh, was descended from an old family of some consideration in the county of Haddington; and his father, a goldsmith in Edinburgh, for some time represented the city in the Scottish parliament. In 1601 he became jeweler to the king, and on the removal of the court to London, he followed his royal master thither, and occupied a shop opposite the Exchange. Heriot was largely indebted for his fortune to the extravagance of the queen, and to the imitation of this extravagance by the nobility. The surplus of his estate, after deducting legacies to his nearest relations and some of his more intimate friends, was bequeathed to found a hospital for the education of freemen's sons of the town of Edinburgh; and its value afterward increased so greatly as to supply funds for the erection of several Heriot foundation schools in different parts of the city.

HERISAU, the largest town in the Swiss half-canton of Appenzell-ausser-Rhoden, is situated at the confluence of the Glatt and Brühlbach, seven miles northwest of Appenzell, and about 2,550 feet above sea-level. Population, 10,000.

HERISTAL. See **HERSTAL**.

HERITABLE JURISDICTIONS, in the law of Scotland, were grants of jurisdiction made to a man and his heirs. They were a usual accompaniment to feudal tenures, and the power which they conferred on great families, being recognized as a source of danger to the state, led to frequent attempts being made by statute to restrict them, both before and after the Union. They are now all abolished.

HERLEN, FRITZ, of Nördlingen, was an artist of the early Swabian school, who tempered the rudeness of his native art with some of the delicacies of the masters of Bruges. The date and place of his birth are unknown, but his name is on the roll of the tax-gatherers of Ulm in 1449; and in 1467 he was made citizen and town painter at Nördlingen, where he died October 12, 1491.

HERMANN, the popular modern name in Germany for the ancient German hero Arminius. (See **GERMANY**).

HERMANN, commonly distinguished as **Hermanus Contractus**, *i. e.*, Hermann or Heriman the Lamé, an old German chronicler and scholar, was born in 1013, a son of the Swabian Count Wolverad (Wolfrat) of Vehreningen (Veringen or Voringen), and died in 1054, at the family residence of Aleshusen near Biberach.

HERMANN, FRIEDRICH BENEDICT WILHELM VON (1795-1868), writer on political economy, was born December 5, 1795, at Dinkelsbühl in Bavaria, and died in 1868.

HERMANN, JOHANN GOTTFRIED JAKOB, classical editor and philologist, was born at Leipsic on November 28, 1772. Entering the university of his native city at the age of fourteen, Hermann at first studied law, but his inclination to classical learning was too strong to be resisted, and accordingly, after a session spent at Jena, in 1793-94, he became a lecturer on classical literature in Leipsic. In 1798 he was appointed professor extraordinarius of philosophy at the university there, and after refusing an invitation to proceed to Kiel as rector of

a school, he was, in 1803, chosen professor of eloquence. In 1809 he received the chair of poetry in addition. He died, senior of the university, on December 31, 1848.

HERMANN, KARL FRIEDRICH, one of the leading representatives of classical investigation in Germany, was born August 4, 1804, at Frankfort-on-the-Main. His early education was received partly at Frankfort and partly at Weilburg, and his university studies were carried on at Heidelberg and Leipsic. On his return from a tour in Italy he habilitated in 1826 as privat-docent in Heidelberg; in 1832 he was called to Marburg as professor ordinarius of classical literature; and in 1842 he was transferred to Göttingen to fill the chair left vacant by the death of Ottfried Müller. Both at Marburg and Göttingen he likewise held the office of director of the philological seminary. He died at Göttingen on January 8, 1856.

HERMANNSTADT, chief town of an Hungarian county of the same name, is situated on the Szeben, an affluent of the Aluta, about seventy-two miles southeast of Kolozsvár (Klausenburg), and is the terminus of the Kapus and Nagy-Szeben branch line of railway. Population (1890), 20,000.

HERMAS. See **APOSTOLIC FATHERS**.

HERMENEUTICS, BIBLICAL, is that branch of theological science which treats of the principles of Scripture interpretation. Various described as the theory of the discovery and communication of the thoughts of Holy Scripture, the science of obtaining clearness both in comprehending and in explaining the sense of the Biblical authors, the methodological preparation for the interpreter and for exegesis, the science of the removal of differences between us and the sacred writers, it has for its task to determine the laws of valid exegetical practice.

HERMÈS is the name of a Greek god (corresponding to the Roman Mercury), whose origin and real character are perhaps more difficult to define than is the case with any other Greek deity. He was not a god worshiped by the pure Doric or Ionic races, but is found in most places where Æolian, Achæan and Pelasgic tribes can be traced. If we begin with the rudest races, summed up generally under the title of Pelasgic, we find Hermes often connected with the mysterious Cabiri. These deities, in the accounts we have, vary in number and sex, being sometimes two, sometimes three or four. We may conclude that originally they were a pair, male and female, whom we may compare with Uranus and Gæa, or with Cronus and Rhea. Often the female is doubled, as mother and daughter, resembling the relation of Demeter and Persephone; while the male also is transformed, either into twin brothers or into a father and his son, by one of the female deities. Certainly the male deity seems sometimes to be regarded as Hermes, sometimes as Hephæstus (see **HEPHÆSTUS**), while in other places the two are associated. Hermes and Hephæstus are perhaps local varieties of one type, which, after having acquired distinct individuality in their separate homes, were brought beside each other by subsequent intercourse. Hence we may understand how the epithet *ἄγγελος* and the office of messenger between gods and men, which in the *Rig Veda* belong to Agni, the fire, are in Greek mythology attached to Hermes. This Pelasgic Hermes is an ithyphallic deity, the god of fertility and reproductive power, and bestower of riches in flocks and herds. In the very mixed Attic people it is not surprising to find the worship of Hermes widespread; it is sometimes said to have been introduced from Samothrace. In Athens, Hermes is the god of social life and intercourse in general, of streets and doorways, and of the palæstra. As god of social intercourse he easily grows into the imper-

sonification of cleverness, and at last into the patron of thieves.

In art, besides the Hermæ already described, Hermes is in the archaic time represented as a man with pointed beard, wearing a chlamys and the broad hat called petasus; his symbols are the staff and the winged shoes. The ideal type of Hermes was probably modeled after the statue by Praxiteles in the Heraion at Olympia.

HERMES, GEORG, a distinguished Catholic theologian, born April 22, 1775, at Dreyerwald, in Westphalia, was educated at the gymnasium and university of Münster. After completing his course of study at Münster, he acted for some time as lecturer at the gymnasium and then as professor at the university. In 1820 he was called, as professor of theology, to the university of Bonn, where he remained till his death on May 26, 1831. Hermes was peculiarly adapted for the life and work of the professoriate. He had great gifts as a lecturer and teacher, and gathered round him at Bonn a devoted band of adherents.

HERMES TRISMEGISTUS. The Egyptian Thoth, Tauut, or Tat, who was identified by the Greeks more or less completely with their own Hermes, is described in the hieroglyphics by various epithets, among which occurs that of "the great great" or twice great, with an added hieroglyphic (a kite) also signifying "great." To him as scribe of the gods, "Lord of the divine words," "Scribe of truth," was attributed the authorship of all the strictly sacred books generally called by Greek authors Hermetic. These, according to Clemens Alexandrinus, our sole ancient authority, were forty-two in number, and were subdivided into six divisions, of which the first, containing the ten books "of the prophets," dealt with laws, deities, and the education of priests; the second, consisting of the ten books of the "stolistes," or official whose duty it was to dress and ornament the statues of the gods, treated of sacrifices and offerings, prayers, hymns, festive processions; the third, "of the hierogrammatist," also in ten books, was a repertory of hieroglyphical, cosmographical, geographical, and topographical information; the four books "of the horoscopus" were devoted to astronomy and astrology; the two books "of the chanter" contained respectively a collection of songs in honor of the gods and a description of the royal life and its duties; while the sixth and last division, consisting of the six books "of the pastophor," was medical. Of this canon, which, according to the generally received opinion of Bunsen, must have been closed, at latest, in the time of the Psammetichi, but probably earlier, numerous small fragments are to be found in the works of Stobæus and other ancient writers. The now well-known *Book of the Dead*, according to Bunsen, originally had its place among the ten ceremonial books of the "stolistes," but this is denied by Lepsius; an ancient papyrus recently deciphered by Ebers is believed by that author to date from about the year 1500 B.C., and to have formed part of one of the books of the pastophor.

HERMESIANAX, an elegiac poet of the Alexandrian school, was born at Colophon, and flourished in the time of Philip and Alexander, or a little later.

HERMOGENES, or Tarsus, Greek rhetorician, flourished in the reign of Marcus Aurelius. His precocious ability secured him a public appointment as teacher of his art while as yet he was only a boy; but at the age of twenty-five his faculties gave way, and he spent the long remainder of his life in a state of intellectual impotency. In the nine or ten years, however, of his activity he composed a whole series of treatises on matters rhetorical, which became popular text books, and the subject of subsequent commentaries.

HERMON, the highest mountain in Syria (9,150 feet above the Mediterranean), an outlier of the Antilebanon. The Sidonians called it Sirion, and the Amorites Shenir. It is probably the "high mountain" near Cæsarea Philippi where the Transfiguration occurred (Mark ix. 2). The modern name is *Jebel esh Sheikh*, or "chief mountain." It is also called *Jebel eth Thelj*, "snowy mountain."

HERMOSILLO, a town of Mexico, state of Sonora, is situated at the entrance to a valley of remarkable fertility, near the river Sonora, at its confluence with the Horcasitas, forty miles southwest of Ures. Some of the principal houses are built of stone, but most of the dwellings are of adobe. The town possesses two churches, a prison, and a mint. Its rise and early prosperity were due to the discovery of gold mines in Sonora, but it now depends wholly on the fertility of the surrounding country, of which the principal products are cotton, wheat, grapes, and a variety of fruits. The town is the commercial center of Sonora. It has cotton manufactories, flour mills, and brandy distilleries, and carries on a considerable foreign trade by means of the port of Guaymas, which is 100 miles distant. The population is about 20,000.

HERMSDORF, generally known as Niederhermsdorf, a town of Prussia, in the government district of Breslau and circle of Waldenburg. Population, 6,000.

HERMUPOLIS, a town of SYRA (*q. v.*).

HERNIA is the protrusion of any viscus from its normal cavity. The word may here be restricted to its most usual meaning, a protrusion of part of the contents of the abdomen from their normal position in the abdominal cavity—in common language, a "rupture." A rupture may occur at any weak point in the abdominal wall. The common situations are the groin (inguinal hernia), the upper part of the thigh (femoral hernia), and the umbilicus or navel (umbilical hernia). The contents of a rupture may be any of the abdominal viscera; the more movable the viscus the more tendency there is to protrusion, and, therefore, we generally find that the small intestine and the omentum are most frequently displaced. Rupture is either congenital or acquired. A child may be born with a hernia in the inguinal or umbilical region, the result of an arrest of development in these parts; or the rupture may be acquired, first appearing, perhaps, in adult life. Ruptures are most frequent at the extremes of life. Men suffer more frequently than women, because they are more liable to accidents, being frequently exposed to intermittent work, such as the lifting of heavy weights.

At first the rupture is small, and with more or less rapidity it gradually increases in size; it varies from the size of a small marble to that of a child's head, or even larger. There are three distinct conditions in which we may find the contents of a hernial tumor; it may be either reducible, irreducible, or strangulated. A "reducible" hernia is one in which the contents can be pushed back into the abdomen. In some cases this is done with ease; in others it is a matter of great difficulty. At any moment a reducible hernia may become "irreducible," that is to say, its contents cannot be pushed back into the abdominal cavity. This may suddenly occur in consequence of an attack of constipation, or slowly, the irreducibility being at first partial and gradually becoming more and more complete. Generally, this is due to an increase in the size of the omentum, accompanied by inflammatory induration. A "strangulated" hernia is one in which the circulation of the blood through the hernial contents is interfered with. The interference is at first slight, but very rapidly tends to become more pronounced. At first there is congestion; this congestion may go on to inflammation;

if unrelieved, the inflammation will end in mortification. The rapidity with which the change from simple congestion to mortification takes place will depend on the tightness of the constricting cause; as a rule, the more rapidly a hernia forms, in other words, the less time the surrounding tissues have to accommodate themselves to the protruding swelling, the greater the rapidity of the changes in the conditions of the contents. The constricting agent may be one or other of the structures which form the boundaries of the openings through which the hernia has traveled in its gradual course through the abdominal wall, or it may lie in the neck of the sac, which has become thickened in consequence of inflammation.

Reducible Hernia.—The symptoms of reducible hernia show themselves in a soft compressible tumor (elastic when it contains intestine, doughy when it contains omentum, a combination of elasticity and doughiness when both are present), its size increasing in the erect, and diminishing in the horizontal posture, whence as a rule it gives little trouble during the night, and becomes more troublesome in the daytime, more especially toward evening. There is a more or less distinct impulse on coughing, and when the intestinal contents are pushed back into the abdomen a gurgling sensation is perceptible by the fingers.

The treatment of reducible hernia consists in pushing back the contents of the tumor into the abdomen, and applying a truss or elastic bandage in order to prevent the contents from again escaping. The younger the patient the more chance there is of the truss acting as a curative agent, as the natural tendency to contraction of the channel through which the hernia protrudes is greater. The truss is frequently laid aside at night, because in the horizontal posture the tendency of the contents to descend is greatly lessened. The truss or bandage should, however, be worn day and night. If, after the hernia is once returned, it is never again allowed to come down, there is a probability of a cure taking place; but if it is allowed to come down occasionally, as it may do, even during the night, in consequence of a cough or from turning suddenly in bed, the parts are stretched, and the contracting process which may have been going on for weeks is undone.

A truss should fit accurately, the necessary amount of pressure being obtained by means of a steel spring, to which a pad is attached. The pad should be so arranged as to press, not into the opening through which the hernia has come, but rather on its side, so as to facilitate its contraction and permanent closure. The main pressure should be in the neighborhood of the neck of the sac; if the pad presses into the opening, the tendency is to keep the opening patent. The principle of the nipple-shaped pad, frequently ordered for umbilical hernia, is evil; a flat pad properly applied and held in position by an elastic bandage is the proper arrangement for restraining an umbilical hernia. No truss is to be applied until the hernia is completely reduced; it will only do harm by pressing on the contents of the unreduced hernia. In some hernia, generally those of large size, it is found impossible to keep them up by means of a truss; in such cases an elastic bandage will sometimes effect the object, in others various operations have been recommended. They are spoken of as "the radical cure of hernia," in contradistinction to the so-called "palliative treatment by means of a truss," and are too purely the work of the accomplished surgeon to be described here.

Irreducible Hernia.—Here the main symptom is a tumor of long standing and generally of large size, in which the contents of the tumor, in whole or in part, cannot be pushed back into the abdomen. The irre-

ducibility is due either to its large size or to changes which have taken place in the contents, either indurations or adhesions. Such a tumor is a constant source of danger; its contents are liable, from their exposed situation, to injury from external violence; it has a constant tendency to increase in size; it may at any time become strangulated, or the contents may inflame, and strangulation may occur secondarily to the inflammation. It is accompanied by dragging sensations referred to the abdomen, colic, dyspepsia, and constipation, which may in its turn lead to obstruction, that is to say, a stoppage of the passage of the contents of that portion of the intestinal canal which lies in the hernial tumor. When an irreducible hernia becomes painful and tender, a local peritonitis has occurred, which resembles in many of its symptoms a case of strangulation.

The treatment of irreducible hernia may be palliative; a bag truss may be worn to prevent the swelling from getting larger; the bowels must be kept open, and all irregularities of diet avoided. A person with such a hernia is in constant danger, and more than palliation is called for. An attempt should be made to reduce the hernia—by laying the patient on his back, raising his buttocks, administering purgatives, and starving him (persevering attention to these points may so reduce the size of the contents that the hernia may be returned); or by means of an elastic bandage carefully applied so as to press continuously on the tumor, and gradually press it back into the abdominal cavity. By this simple means large irreducible herniæ, which have withstood all attempts at reduction, have been returned into the abdomen after elastic pressure has been carefully and continuously applied for a few days. If these measures fail active surgical interference must at once be invoked.

Strangulated Hernia.—In this the contents are constricted, and the flow of blood into the tumor and from the tumor is stopped. The symptoms are—nausea, vomiting first of bilious matter, after a time of fecal matter, a twisting, burning pain generally referred to the umbilicus, intestinal obstruction, a quick, wiry pulse, pain on pressure over the tumor and in the abdomen near the tumor, the abdomen tense and tympanitic, and no impulse on coughing, because the contents of the tumor are practically cut off from the general abdominal contents. The patient has an anxious expression. Sooner or later, from eight hours to eight days, if the strangulation is unrelieved, the tumor will become livid and emphysematous; mortification has occurred, and gangrene of the bowel at the neck of the sac will take place, followed by extravasation of the intestinal contents into the abdominal cavity; the patient becomes collapsed, and dies comatose.

The treatment of a strangulated hernia admits of no delay; delay is fatal. A surgeon should be at once employed. Anyone suffering from hernia should take great care to obtain an accurately fitting truss, and should remember that, whenever any symptoms resembling in any degree those of strangulation occur, any delay in the treatment is not only dangerous but may prove fatal. A medical man should at once be communicated with. If an operation is necessary, the operation is not in itself a dangerous one, while, on the other hand, any delay is most certainly excessively dangerous.

HERNÖSAND, chief town and seat of the administration of the län of Wester Norrland on the east coast of Sweden, is built on the island of Hernö (connected with the mainland by bridges), about three miles south of the mouth of the Angerman river, and 230 miles north of Stockholm. Population (1890), 5,500.

HERO AND LEANDER. Hero, the beautiful priestess of Venus at Sestos, was there seen by Leander, a youth of Abydos, at the celebration of the festival of

Venus and Adonis. He became deeply enamored of her, and found that day an opportunity of declaring his passion, which she returned; and as her position rendered their marriage impossible, they agreed to carry on a clandestine intercourse. Nightly Hero placed a lamp in the top of the tower where she dwelt by the sea, and Leander, guided by it, swam the dangerous Hellespont. One stormy night the lamp was blown out, and Leander perished. On finding his body next morning on the shore, Hero flung herself into the waves.

HEROD was the name of a family of Idumæan origin, which displaced the Asmoneans as the rulers of Judæa. The founder of the dynasty, and its most notable representative in every way, was Herod the Great, who was king of the Jews for about thirty-seven years, from 40 to 4 B.C. Herod's father was Antipater, who during the troubles which broke out in the family of Alexander Jannæus, attached himself to Hyrcanus, the weak-minded son of Alexander. In this way Antipater, though an Idumæan, soon became the most powerful man in Judæa, and in the Alexandrian war gave such effectual help to Julius Cæsar that the dictator made him procurator of Judæa, Hyrcanus being high priest, (47 B.C.) The same year, at the age of twenty-five, Herod was appointed governor of Galilee by his father. He soon gave proof of the remarkable energy of his character in rooting out the banditti who infested his province; but his summary measures gave a handle to the enemies of his house at Jerusalem, and he was summoned before the sanhedrin. There he appeared, not in the garb of an accused person, but gorgeously attired, and attended by a guard of soldiers. He found it expedient, however, to withdraw from Jerusalem without awaiting the sentence. He retired to Syria, where he met with a gracious reception from Sextus Cæsar, who appointed him governor of Cœle-Syria. Herod now marched with an army against Jerusalem, but at the persuasion of his father and brother was induced to depart without exacting vengeance on his enemies. After the death of Cæsar, the fortunes of Herod were affected by all the changes which befell the Roman state. When Cassius took the command in the East, and began to gather his strength for the final struggle which was decided at Philippi, Herod managed to win his favor by the readiness with which he raised his share of the heavy exactions imposed upon the East. About the same time his father was poisoned, and to Herod fell the task of avenging his death, as well as of supporting the interests of his house in Palestine. After Philippi he gained Antony over by large presents of money. He and his brother Phasael were appointed tetrarchs of Judæa. In 40 B.C. the Parthians appeared upon the scene, overran the whole of Syria, and placed on the throne of Judæa Antigonus, son of Aristobulus, and representative of the rival branch of the Asmonean house. Herod was completely overpowered; and, after placing his relatives in safety, so far as he could, he hastened to Rome to lay his case before Antony and Octavianus. He succeeded beyond his expectations, for, while he meant only to advocate the claims of Hyrcanus the Asmonean, the two heads of the state made him king of Judæa. Herod returned home without delay, and set about the task of winning the kingdom allotted to him. Owing chiefly to the slackness of the Roman generals who should have helped him, it was three years before he succeeded in taking Jerusalem, (37 B.C.) Before that event he had married the beautiful Mariamne. Herod's early measures were cruel; he put to death all the members of the sanhedrin except two, and spared no one that was likely to stand in his way. Aristobulus, the youthful brother of Mariamne, whom he had appointed high

priest, he caused to be treacherously drowned because he was too popular with the patriotic party. On this occasion Alexandra, mother of Aristobulus, induced Cleopatra to take her part, and Herod had to appear before Antony to answer the charge of murdering the prince. Again Herod knew how to gain the Roman, and he returned home with confirmed power. During the war of Actium, Herod had the good fortune to be engaged in a war with the King of Arabia on Antony's behalf, and so escaped the risk of fighting against Octavianus. Hastening to Rhodes (30 B.C.), he appeared in the presence of the conqueror, and avowing his loyalty to his friend Antony, proffered the same faithful service to Octavianus. Octavianus was gracious, and remained the constant friend and patron of Herod to the end. This was the last crisis of Herod's life; he was henceforward undisputed king of Judæa, and next to Agrippa the most trusted friend of Augustus. But while the friend of the great and prosperous in all external relations, Nemesis pursued him in his family. When summoned to answer for himself before Antony, and again on his journey to Rhodes, he left the beautiful and beloved Mariamne in charge of one of his friends, but with the cruel injunction that she should be put to death should any thing serious befall himself. On both occasions Mariamne discovered the secret, and, instead of regarding the command as a proof of his jealous love, abhorred it as another instance of the cruelty which had not spared so many of her nearest relatives. A horrible tragedy ensued: Mariamne openly expressed her disgust; and Herod, furious with rage, jealousy, and rejected love, ordered her death. The violence of his feelings threw him into a dangerous malady, and even drove him to the verge of insanity. His turbulent subjects were kept tolerably quiet in spite of heavy taxes. He managed to gratify his love for Greek and Roman life; and yet he avoided wounding too deeply the susceptibilities of the Jews. The magnificent buildings which he raised were the most brilliant products of his reign. He rebuilt Samaria, calling it Sebaste, from the Greek name for Augustus. He converted the small town of Strato's Tower into a magnificent seaport with an artificial harbor, under the name of Cæsarea. These and other towns which he built were furnished with temples, theaters, aqueducts, and all the other ornamental and useful appliances of Greek and Roman life. In the city of Jerusalem even he built a theater, and an amphitheater outside of it. A more patriotic work was the rebuilding of the temple (begun 20 B.C.), which had suffered greatly during the late troubles; it was on a very magnificent scale, and lasted nine years and a half, even then being unfinished. The last years of Herod's life were darkened by the return of those family troubles which had previously overcast it. His two sons by Mariamne had been educated at Rome, and returned, 17 B.C., to Judæa. Their father himself was proud of them. But Pheroras and Salome, brother and sister of Herod, did all they could to sow jealousy and suspicion. Herod's mind was too painfully open to dark insinuations, and he recalled his eldest son Antipater to counterbalance the influence of the Asmonean princes. After the arrival of Antipater, who was a most unscrupulous plotter, there was no more peace or security at the court of Herod; things went from bad to worse, till after many years of the darkest intrigue and the bitterest domestic contention, the two sons of Mariamne were strangled at Sebaste. Soon after the clearest proof was discovered of a conspiracy which Antipater had formed with Pheroras against the life of Herod himself. The order for the death of Antipater was given by Herod from his death-bed. His health had long been

failing; after the cruelest torments of both mind and body, he died 4 B.C. The birth of Christ took place in the same year as Herod's death, but this, as is well known, occurred four years before the date fixed as the beginning of the Christian era. The massacre of the little children at Bethlehem is not mentioned by Josephus among the horrors of Herod's last days. He was buried with great magnificence. His will, by which the greater part of his dominions was bequeathed to his sons by Malthace, a Samaritan, was confirmed by Augustus.

HEROD ANTIPAS, son of Herod the Great, by the Samaritan Malthace, and brother of Archelaus, received as his share of his father's dominions the provinces of Galilee and Peræa. Like his father, Antipas had a turn for architecture: he rebuilt and fortified the town of Sepphoris; he also fortified Betharamptha, and called it Julias, after the wife of the emperor. Above all he founded the important town of Tiberias, on the west shore of the Sea of Galilee, with institutions of a distinctly Greek character. Antipas is mentioned more than once in gospel history under the name of Herod. He it was who was called a "fox" by Christ. He is erroneously spoken of as a king in Mark vi. 14. It was to him that Jesus was sent by Pilate to be tried. But it is in connection with his wife, Herodias, that he is best known, and it was through her that his misfortunes arose. He was married first of all to a daughter of Aretas, the Arabian king; but, making the acquaintance of Herodias, the wife of his brother Philip (not the tetrarch), during a visit to Rome, he was fascinated by her, and arranged to marry her. Meantime his Arabian wife discovered the plan and escaped to her father, who made war on Herod, and completely defeated his army. John the Baptist condemned his marriage with Herodias, and, in consequence, was put to death in the way described in the gospels and in Josephus. When Herodias' brother, Agrippa, was appointed king by Caligula, she was determined to see her husband attain to an equal eminence, and persuaded him, though naturally of a quiet and unambitious temperament, to make the journey to Rome to crave a crown from the emperor. Agrippa, however, managed to influence Caligula against him. Antipas was deprived of his dominions, and banished to Lyons, Herodias voluntarily sharing his exile.

HEROD PHILIP, son of Herod the Great, by Cleopatra of Jerusalem, received the tetrarchate of Ituræa, and other districts to the northeast of the Jordan. He is a different person from the first husband of Herodias, also called Philip by St. Mark (vi. 17), and was married to Salome, the daughter of Herodias. Philip is described as an excellent ruler, who loved peace, and was careful to maintain justice, and spent his time in his own territories. He was also a builder of cities, one of which was Cæsarea Philippi, and another was Bethsaida, which he called Julias. He died after a reign of thirty-seven years; and his dominions were incorporated in the province of Syria.

HERODIANS, a sect or party mentioned in Scripture as having on two occasions — once in Galilee, and again in Jerusalem — manifested an unfriendly disposition toward Jesus. In each of these cases their name is coupled with that of the Pharisees. According to many interpreters the courtiers or soldiers of Herod Antipas are intended; but more probably the Herodians were a public political party, who distinguished themselves from the two great historical parties of post-exilian Judaism by the fact that they were and had been sincerely friendly to Herod the Great and to his dynasty.

HERODIANUS, the author of a Greek history of the period extending from 180 to 238 A.D. Of his

origin and condition in life very little is known. He was in Rome in 203, and seems to have held some public office. It has been conjectured that he was first "procurator Cæsaris" and afterward "legatus" of the Sicilian provinces, and that, while fulfilling his official duties, he wrote at intervals the history which bears his name. The narrative is of special value for the reigns of the emperors subsequent to Alexander Severus, with whom the work of Dion Cassius ends.

HERODIANUS, ÆLIUS, a famous grammarian of antiquity, called by Priscian "maximus auctor artis grammaticæ." He was the son of the grammarian Apollonius, was born at Alexandria, and resided at Rome. He was patronized by the emperor Marcus Aurelius (161–180 A.D.), to whom he dedicated his great treatise on prosody. This was a work in twenty books, which included also an account of the etymological part of grammar. An epitome of it has been preserved.

HERODOTUS, according to the best authorities, was born in or about the year 484 B.C. He was a native of Halicarnassus, a city which belonged originally to the Doric Hexapolis, situated toward the southwestern corner of Asia Minor, but which from a date considerably anterior to the birth of Herodotus had been excluded from the confederacy, and was an isolated Greek town, dependent upon the Persians. Herodotus was thus born a Persian subject, and such he continued until he was thirty or thirty-five years of age.

Of the education of Herodotus no more can be said than that it was thoroughly Greek, and embraced no doubt the three subjects essential to a Greek liberal education — grammar, gymnastic training, and music. It is clear from the extant work of Herodotus that he must have devoted himself earlier to the literary life, and commenced that extensive course of reading which renders him one of the most instructive as well as one of the most charming of ancient writers. The poetical literature of Greece was in his time already large; the prose literature was more extensive than is generally supposed; yet Herodotus shows an intimate acquaintance with the whole of it. He has drunk at the Homeric cistern till his entire being is impregnated with the influence thence derived. The *Iliad* and the *Odyssey* are as familiar to him as Shakespeare to the most highly educated of modern Englishmen. He is acquainted with the poems of the epic cycle, the *Cypria*, the *Epigoni*, etc. He quotes or otherwise shows familiarity with the writings of Hesiod, Olen, Musæus, Bacis, Lysistratus, Archilochus of Paros, Alcæus, Sappho, Solon, Æsop, Aristæas of Proconnesus, Simonides of Ceos, Phrynichus, Æschylus, and Pindar. He quotes and criticises Hecataeus, the best of the prose writers who had preceded him, and makes numerous allusions to other authors of the same class. It may be questioned whether there was any single work of importance in the whole range of extant Greek literature with the contents of which Herodotus had not made himself acquainted by the time that he undertook the composition of his "History."

It must not, however, be supposed that the great Halicarnassian was at any time a mere recluse student. There can be no reasonable doubt that from a very early age his inquiring disposition led him to engage in travels, both in Greece and in foreign countries, which must have been continued year after year for a considerable period, and which made him as familiar with men as with books. He traversed Asia Minor and European Greece in all directions, probably more than once; he visited all the most important islands of the Archipelago — Rhodes, Cyprus, Delos, Paros, Thasos, Samothrace, Crete, Samos, Cythera, and Ægina. He undertook the

long and perilous journey from Sardis to the Persian capital Susa, passed some considerable time at Babylon, and went a voyage to Colchis, and another along the western shores of the Black Sea as far as the estuary of the Dnieper; he traveled in Scythia and in Thrace, visited Zante and Magna Græcia, explored the antiquities of Tyre, coasted along the shores of Palestine, saw Gaza, and made a long stay in Egypt. At the most moderate estimate, his travels covered a space of thirty-one degrees of longitude, or 1,700 miles, and twenty-four of latitude, or nearly the same distance. Nor was he content, like the modern tourist, with hasty glimpses of the countries which he visited. At all the more interesting sites he took up his abode for a time; he examined, he inquired, he made measurements, he accumulated materials. Having in his mind the scheme of his great work, he gave ample time to the elaboration of all its parts, and took care to obtain by personal observation a full knowledge of all the various countries which were to form the scene of his narrative.

The travels of Herodotus seem to have been chiefly accomplished between his twentieth and his thirty-seventh year, (464-447 B.C.) It was probably in his early manhood that as a Persian subject he visited Susa and Babylon, taking advantage of the Persian system of posts which he describes in his fifth book. His residence in Egypt must, on the other hand, have been subsequent to 460 B.C., since he saw the skulls of the Persians slain by Inarus in that year. On his return from Egypt, as he proceeded along the Syrian shore, he seems to have landed at Tyre, and thence to have gone to Thasos, which lay off the coast of Thrace. His Scythian travels are thought to have taken place prior to 450 B.C. We are told that when he quitted Halicarnassus on account of the tyranny of Lygdamis, in or about the year 457 B.C., he took up his abode in Samos. That island was an important member of the Athenian confederacy, and in making it his home Herodotus would have put himself under the protection of Athens. The fact that Egypt was then largely under Athenian influence may have induced him to proceed, in 457 or 456 B.C., to that country. The complete knowledge that he has of the whole of Egypt indicates a stay there of some years, and it was perhaps not till 454 B.C. that he returned to his Samian home. The stories that he had heard in Egypt of Sesostris may then have stimulated him to make voyages from Samos to Colchis, Scythia, and Thrace. When he had seen these countries, he had made acquaintance with almost all the regions which were to be the scene of his projected history, and could apply himself to the task of its composition with the comfortable feeling that he possessed all the local knowledge requisite for graphic and telling description.

After Herodotus had resided for some seven or eight years in Samos, events occurred in his native city which induced him to return thither. There is reason to believe that his first attempts to push himself into notice were not received with much favor—the prophet did not obtain much honor in his own country—his countrymen ridiculed the work which they had been expected to admire; and the disappointed author, chagrined at his failure, precipitately withdrew from his native town, and sought a refuge in Greece proper, (about 447 B.C.)

A writer of late date (125-200 A.D.) and low credit, Lucian of Samosata, in one of his rhetorical pieces, declares that on quitting Halicarnassus Herodotus proceeded straight to Olympia, and finding the quadrienial festival in progress recited his work to the assembled multitudes, who were highly delighted with it; and freely expressed their admiration. The statement, however, is improbable, and is rejected by most critics.

From earlier and better writers we learn that Athens was the place to which the disappointed author betook himself, and that he appealed from the verdict of his countrymen to Athenian taste and judgment. By recitations held in that city he made his work known to the best Grecian intellects, and won such approval that in the year 445 B.C., on the proposition of a certain Anytus, he was voted a sum of ten talents by decree of the people. At one of the recitations Thucydides was present with his father, Olorus, and was so moved that he burst into tears, whereupon Herodotus remarked to the father—"Olorus, your son has a natural enthusiasm for letters."

Athens was at this time the center of intellectual life, and could boast a galaxy of talent such as has rarely been gathered together either before or since. The stately Pericles, his clever rival Thucydides the son of Melesias, the fascinating Aspasia, the eloquent Antiphon, the scientific musician Damon, the divine Phidias, Protagoras the subtle disputant, Zeno the inventor of logic, the jovial yet bitter Cratinus, the gay Crates, Euripides the master of pathos, Sophocles the most classic even of the ancients, formed a combination of which even Athens might be proud, and which must have charmed the literary aspirant. Accepted into this brilliant society, on familiar terms with all probably, as he certainly was with Olorus, Thucydides, and Sophocles, he cannot but have found his Attic sojourn delightful, and have been tempted, like many another foreigner, to make Athens his permanent home. In the year 444 B.C., on the scheme of sending a colony to Thurii in Italy being broached by Pericles, Herodotus was among those who gave in their names; and in the spring of the following year he sailed from Athens to Italy with the other colonists, and became a citizen of the new town.

From this point of his career, when he had reached the age of forty, we lose sight of Herodotus almost wholly. He seems to have made but few journeys, one to Crotona, one to Metapontum, and one to Athens (about 430 B.C.) being all that his work indicates. No doubt he was employed mainly, as Pliny testifies, in retouching and elaborating his general history. He may also have composed at Thurii that special work on the history of Assyria to which he twice refers in his first book, and which is quoted by Aristotle. It has been supposed by many that he lived to a great age, but the indications derived from the later touches added to his work, which form the sole evidence on the subject, would rather lead to the conclusion that his life was not very prolonged. There is nothing in the nine books which may not have been written as early as 430 B.C.; there is no touch which, even probably, points to a later date than 424 B.C. As the author was evidently engaged in polishing up his work to the last, and even promises touches which he does not give, we may assume that he did not much outlive the date last mentioned, or in other words, that he died at about the age of sixty. The predominant voice of antiquity tells us that he died at Thurii, where his tomb was shown in later ages.

HÉROLD, LOUIS JOSEPH FERDINAND, French musician, was born in Paris, January 28, 1791, the son of François Joseph Hérold, an accomplished pianist. It was not till after his father's death that Hérold in 1806 entered the Paris conservatoire, where he studied under Catel and Méhul, one of the leading composers of the time, by whose teaching his pupil profited soon and permanently. In 1812 he gained the grand prix de Rome (a traveling scholarship awarded by the French Government to the best pupils of the conservatoire), and accordingly started for Italy, where he remained till 1815, and composed a symphony, a cantata, and several pieces of chamber music. It was also during his

stay in Italy that Hérold for the first time ventured on the stage with the opera *La Gioventù di Enrico V.*, first performed at Naples in 1815 with moderate success. Returning to Paris he had the good fortune to be invited by Boieldieu to participate in the composition of an opera called *Charles de France*, performed in 1816, and soon followed by Hérold's first French opera, *Les Rosières* (1817), which was received very favorably. Of the numerous dramatic works which Hérold produced for the next fifteen years in rapid succession it is unnecessary to give a detailed account. Only the names of some of the more important may be mentioned here: *La Clochette* (1817), *L'Auteur mort et vivant* (1820), *Marie* (1826), and the ballets *La Fille mal Gardée* (1828), and *La Belle au bois dormant* (1829). In 1831 he produced one of the two works which have given immortality to his name, the romantic opera *Lampa*, which has met with immense success not only in France but also in Germany, where it has kept the stage till the present day, and is considered Hérold's masterpiece. In France that eminence is justly accorded to the *Le Pré aux Clercs* (first performance December 15, 1832), in every way a representative work of the French school, in which French *esprit* and French chivalry find their most perfect embodiment. Hérold died January 19, 1833.

HERON, or HERO, a mathematician and natural philosopher of Alexandria, was the pupil of Ctesibius, and flourished probably about a century or a century and a half before Christ. His name has been preserved in the well-known experiment of Hero's fountain, in which, by means of condensed air, water is made to spring from a jet in a continuous stream.

HERON, called the younger, to distinguish him from his namesake of Alexandria, was, like him, a mathematician and natural philosopher. By some he is supposed to have flourished in the first half of the seventh century A.D.; by others, with more probability, to have lived at Constantinople in the tenth century. He wrote a treatise on *Besieging Engines* which still exists, and another on the *Construction of Sun-dials*, which is now lost.

HERON, a long-necked, long-winged, and long-legged bird, the representative of a very natural group, the *Ardeidae*, which through the neglect or ignorance of ornithologists has been for many years encumbered by a considerable number of alien forms, belonging truly to the Cranes, *Gruidæ* and Storks, *Ciconiidae*, whose structure and characteristics are wholly distinct, however much external resemblance some of them may possess to the Herons. Eliminating these intruders, it is difficult or even impossible to estimate with any accuracy the number of species of *Ardeidae* which exist.

The common Heron of Europe, *Ardea cinerea* of Linnæus, is universally allowed to be the type of the family. The species inhabits localities throughout the whole of Europe, Africa, and Asia, reaching Japan, many of the islands of the Indian Archipelago, and even Australia. The sites chosen by the Heron for its nest vary greatly. It is generally built in the top of a lofty tree, but not infrequently (and this seems to have been much more usual in former days) near or on the ground among rough vegetation, on an island in a lake, or again on a rocky cliff of the coast. It commonly consists of a huge mass of sticks, often the accumulation of years, lined with twigs, and in it are laid from four to six sea-green eggs. The young are clothed in soft flax-colored down, and remain in the nest for a considerable time, therein differing remarkably from the "pipers" of the Crane, which are able to run almost as soon as they are hatched. The first feathers assumed by young Herons in a general way resemble those of the adult, but the

fine leaden-gray back, the pure white breast, the black throat-streaks, and especially the long pendent plumes, which characterize only the very old birds, and are most beautiful in the cocks, are subsequently acquired. The Heron measures about three feet from the bill to the tail, and the expanse of its wings is sometimes not less than six feet, yet it weighs only between three and four pounds.

Large as is the common Heron of Europe, it is exceeded in size by the Great Blue Heron of America, *Ardea herodias*, which generally resembles it in appearance and habits, and both are smaller than the *A. sumatrana* or *A. typhon* of India and the Malay Archipelago, while the *A. goliath*, of wide distribution in Africa and Asia, is the largest of all. The Purple Heron, *A. purpurea*, as a well-known European species having a great range over the Old World, also deserves mention here.

HEROPIIILUS. See ANATOMY.

HERRERA, FERNANDO DE, lyrical poet, born at Seville, Spain, in 1534. Herrera has been celebrated in a sonnet by Cervantes; and his poems were taken as models by the later poet, Lope de Vega. He died at Seville in 1597.

HERRERA, FRANCISCO (1576-1656), surnamed el Viejo (the old), historical and fresco painter, studied under Luis Fernandez in Seville, his native city, where he spent the most of his life. He was a skillful worker in bronze, an accomplishment that led to his being charged with coining base money. From this accusation, whether true or false, he sought sanctuary in the Jesuit college of San Hermenegildo, which he adorned with a fine picture of its patron saint. Philip IV., on his visit to Seville in 1624, having seen this picture, and learned the position of the artist, pardoned him at once, warning him, however, that such powers as his should not be degraded. In 1650 Herrera removed to Madrid, where he lived in great honor till his death in 1656.

HERRERA, FRANCISCO (1622-1685), surnamed el Mozo (the young), historical and fresco painter, son of the subject of the last notice, was also a native of Seville. Unable to endure his father's cruelty, the younger Herrera, seizing what money he could find, fled to Rome. There, instead of devoting himself to the antiquities and the works of the old Italian masters, he gave himself up to the study of architecture and perspective, with the view of becoming a fresco-painter. He did not altogether neglect easel-work, but became renowned for his pictures of still-life, flowers, and fruit, and from his skill in painting fish was called by the Italians *Lo Spagnuolo degli pesci*. In later life he painted portraits with great success. He returned to Seville on his father's death; and in 1660 was appointed subdirector of the new academy there under Murillo. He went to Madrid, and was employed to paint a San Hermenegildo for the barefooted Carmelites, and to decorate in fresco the roof of the choir of San Felipe el Real. The success of this last work procured for him a commission from Philip IV. to paint in fresco the roof of the Atocha church. He chose as his subject for this the Assumption of the Virgin. Soon afterward he was rewarded with the title of painter to the king, and was appointed superintendent of the royal buildings. He died at Madrid in 1685.

HERRERA Y TORDESILLAS, ANTONIO DE, Spanish historian, was born in 1549, at Cuellar, in the province of Segovia in Spain. Philip II. of Spain appointed Herrera first historiographer of the Indies, and one of the historiographers of Castile. Placed thus in the enjoyment of an ample salary, Herrera devoted the rest of his life to the peaceful pursuit of literature, retaining his offices till the reign of Philip IV., by whom

he was appointed secretary of state, very shortly before his death, which took place at Madrid on March 29, 1625.

HERRICK, ROBERT, English poet, was born at Cheapside, London, in August, 1591. He seems to have been present at the first performance of *The Alchemist* in 1610, and it was probably about this time that Ben Jonson adopted him as his poetical "son." He entered the university as fellow-commoner of St. John's College, and he remained there until, in 1616, upon taking his degree, he removed to Trinity Hall; in 1620 he became master of arts. From this date until 1629 we entirely lose sight of him; it has been variously conjectured that he spent these nine years preparing for the ministry at Cambridge, or in much looser pursuits in London. In the latter year he was presented to the rural living of Dean Prior, in Devonshire. He entered upon this new career on October 2, 1629, being in his thirty-ninth year. At Dean Prior he resided quietly until 1648, when he was ejected by the Puritans. He was pleased with the rural and semi-pagan customs that survived in the village, and in some of his most charming verses he has immortalized the morris-dances, wakes, and quintains, the Christmas mummers and the Twelfth-Night revelings, that diversified the quiet Dean Prior. Herrick never married, but lived at the vicarage surrounded by a happy family of pets. His first appearance in print was in some verses he contributed to *A Description of the King and Queen of the Fairies*, in 1635. In 1640 a volume of *Wit's Recreations* contained sixty-two small poems afterward acknowledged by Herrick in the *Hesperides*, and one not reprinted until our own day. In 1648 he published his celebrated collection of lyrical poems, entitled *Hesperides, or the Works both Human and Divine of Robert Herrick*, only a few weeks, it would seem, after his ejection from his living by the Puritans. That he was reduced to great poverty in London has been stated, but Doctor Grosart shows this to be very unlikely. In August, 1662, Herrick returned to Dean Prior, supplanting his own supplanter, Dr. John Symes. He died in his eighty-fourth year, and was buried at Dean Prior, October 15, 1674. As a pastoral lyrist Herrick stands first among English poets. His genius is limited in scope, and comparatively unambitious, but in its own field it is unrivaled. His tiny poems—and of the thirteen hundred he has left behind him not one is long—are like jewels of various value, heaped together in a casket. Some are of the purest water, radiant with light and color, some were originally set in false metal that has tarnished, some were rude and repulsive from the first.

HERRING (*Clupea harengus*), a fish belonging to the genus *Clupea*, of which more than sixty different species are known in various parts of the globe. The sprat, pilchard or sardine, and shad are species of the same genus. Of all sea-fishes *Clupea* are the most abundant; for although other genera may comprise a greater variety of species, they are far surpassed by *Clupea* with regard to the number of individuals. The majority of the species of *Clupea* are of greater or less utility to man; it is only a few tropical species that acquire, probably from their food, highly poisonous properties, so as to be dangerous to persons eating them. But no other species equals the Common Herring in importance as an article of food or commerce. It inhabits in incredible numbers the German Ocean, the northern parts of the Atlantic, and the seas north of Asia. The herring inhabiting the corresponding latitudes of the North Pacific is another species, but most closely allied to that of the eastern hemisphere. Formerly it was the general belief that the herring inhabits the open ocean close to the Arctic Circle, and that it migrates at certain seasons toward the

northern coasts of Europe and America. This view has been proved to be erroneous, and we know now that this fish lives throughout the year in the vicinity of the shores, but at a greater depth, and at a greater distance from the coast, than at the time when it approaches land for the purpose of spawning.

Herrings are readily recognized and distinguished from the other species of *Clupea* by having an ovate patch of very small teeth on the vomer (that is, the center of the palate). In the dorsal fin they have from seventeen to twenty rays, and in the anal fin from sixteen to eighteen; there are from fifty-three to fifty-nine scales in the lateral line, and invariably fifty-six vertebræ in the vertebral column. They have a smooth gill-cover, without those radiating ridges of bone which are so conspicuous in the pilchard and other *Clupea*. The sprat cannot be confounded with the herring, as it has no teeth on the vomer, and only forty-seven or forty-eight scales in the lateral line.

Herrings grow very rapidly. The size which they finally attain and their general condition depend chiefly on the abundance of food (which consists of crustaceans and other small marine animals), on the temperature of the water, on the season at which they have been hatched, etc. Their usual size is about twelve inches, but in some particularly suitable localities they grow to a length of fifteen inches, and instances of specimens measuring seventeen inches are on record. In the Baltic, where the water is gradually losing its saline constituents, thus becoming less adapted for the development of marine species, the herring continues to exist in large numbers, but as a dwarfed form, not growing either to the size or to the condition of the North-Sea herring. The herring of the American side of the Atlantic is specially identical with that of Europe. A second species (*Clupea leachii*) has been supposed to exist on the British coast; but it comprises only individuals of a smaller size, the produce of an early or late spawn. Also the so-called "whitebait" is not a distinct species, but consists chiefly of the fry or the young of herrings, and is obtained in perfection at localities where these small fishes find an abundance of food, as in the estuary of the Thames. The important subject of herring-fishing has already been treated in the article FISHERIES.

HERRNHUT, a town of Saxony, in the circle and eighteen miles southeast of the town of Bautzen, is chiefly known as the principal seat of the Moravian or Bohemian Brotherhood, styled on the Continent Herrnhuter, a colony of whom, fleeing from persecution in their own country, settled at Herrnhut in 1722, on a site presented by Count Zinzendorf.

HERSCHEL, CAROLINE LUCRETIA, sister of Sir William Herschel, the eighth child and fifth daughter of her parents, was born at Hanover on March 16, 1750. In the autumn of 1772, she accompanied to England her brother William, who had established himself as a teacher of music in Bath. At once she became a valuable coöperator with her brother, both in his professional duties and in the astronomical researches to which he had already begun to devote all his spare time. She was the principal singer at his oratorio concerts, and acquired such a reputation as a vocalist that she was offered an engagement for the Birmingham festival, which, however, she declined. When her brother accepted the office of astronomer-royal, she became his constant assistant in his observations, and also executed the laborious calculations which were connected with them. For these services she in 1787 received from the king a salary of £50 a year. Her chief amusement during her leisure hours was to sweep the heavens with a small Newtonian telescope planted on the lawn.

Besides detecting by this means many of the small nebulae included in Sir William Herschel's catalogue, she succeeded in discovering seven comets, in the discovery of five of which she could lay claim to priority, viz., those of 1786, 1788, 1791, 1793, and 1795. In 1797 she presented to the Royal Society a catalogue of 560 stars taken from Flamsteed's observations, and not included in the British catalogue, together with a collection of errata that should be noticed in the same volume. Though she returned to Hanover in 1822 she did not abandon her astronomical studies, and in 1828 she completed the reduction, to January, 1800, of 2,500 nebulae discovered by her brother. In 1835, the Astronomical Society, to mark their sense of the benefits conferred on science by such a series of laborious exertions, unanimously resolved to present her with their gold medal, and also elected her an honorary member of the society. In 1846 she received a gold medal from the king of Prussia. She retained the use of her intellectual faculties, and also preserved her interest in science, to the close of a long life. Her death took place on January 9, 1848.

HERSCHEL, SIR FREDERICK WILLIAM, generally known as Sir William Herschel, one of the most illustrious of astronomers, was born at Hanover, November 15, 1738. His father was a musician employed as hautboy player in the Hanoverian guards. Herschel's earlier education was necessarily of a very limited character, but, being at all times an indomitable student, he, by his own exertions, more than repaired this deficiency of his youth. He became a very skillful musician, both theoretical and practical; while his attainments as a self-taught mathematician were fully adequate to the prosecution of those branches of astronomy which, by his labors and his genius, he so eminently advanced and adorned. Whatever he did he did methodically and thoroughly; and in this methodical thoroughness lay the secret of what Arago very properly terms his astonishing scientific success.

In 1755, at the age of seventeen, he joined the band of the Hanoverian guards, and with his detachment visited England, accompanied by his father and eldest brother; in the following year he returned to his native country, but two years later he finally quitted Hanover to seek his fortunes in England. As might have been expected, the earlier part of his career in his adopted country was attended with formidable difficulties and much privation. We find him engaged in several towns in the north of England as organist and teacher of music, but these were occupations not attended with any lucrative results. In 1766 the tide of his fortunes began to flow, inasmuch as he obtained the appointment of organist to the Octagon Chapel in Bath, at that time the resort of the wealth and fashion of the city, and of its numerous distinguished visitors.

The next five or six years of his life were spent in establishing his reputation as a musician, and he thereby eventually became the leading musical authority in the place, and the director of all the chief public musical entertainments. His circumstances having thus become easier, he revisited Hanover for the purpose of bringing back with him his sister Caroline, with the view of her rendering him such services as she could in his multifarious undertakings. She arrived in Bath with her brother in August, 1772, being at that time in her twenty-third year. In those days telescopes were very rare, very expensive, and not very efficient, for the Dollands had not as yet perfected even their beautiful little achromatics of two and three-quarter inches aperture. So Herschel was obliged to content himself with hiring a small Gregorian reflector of about two inches aperture, which he had seen exposed for loan in a trades-

man's shop. Not satisfied with this implement, he procured a small lens of about eighteen feet focal length, and set his sister to work on a pasteboard tube of that length, so as to make him a telescope. A tube of this construction naturally bent, and it was useless for all purposes but for the determined eyes of William Herschel. This material was soon displaced for tin, and thus a sorry sort of vision was obtained of Jupiter and Saturn and the moon. He then sought for a reflector of much larger dimensions from artists in London. No such instrument, however, was for sale; and the terms demanded for the construction of a reflecting telescope of five or six feet focal length he regarded as too exorbitant even for the gratification of such desires as his own. So he was driven to the only alternative that remained; he must construct a large telescope for himself. His first step in this direction was to purchase the debris of an amateur's implements for grinding and polishing small mirrors; and thus, by slow degrees, and by indomitable perseverance, he in 1774 had, as he says, the satisfaction of viewing the heavens with a Newtonian telescope of six feet focal length constructed by his own hands. But he was not a man to be contented with viewing the heavens as a mere star-gazer; on the contrary, he had from the very first conceived the gigantic project and the hope of surveying the entire heavens, and, if possible, of ascertaining the plan of their general structure on a settled and systematic mode of procedure, if only he could provide himself with adequate instrumental means. With this view he, his brother, and his sister toiled for many years at the grinding and polishing of hundreds of specula, always retaining the best, and recasting the others, until the best of the previous performances had been surpassed. After 1774 every available hour of the night was devoted to the long-hoped-for scrutiny of the skies. In those days no machinery had been invented for the construction of telescopic mirrors; the man who had the hardihood to undertake the polishing doomed himself to walk leisurely and uniformly round an upright post for many hours, without removing his hands from the mirror, until his work was done. On these occasions Herschel received his food from the hands of his faithful sister. But his reward was nigh.

In May, 1780, his first two papers containing some of the results of his astronomical observations during the last six years were communicated to the Royal Society through the influential introduction of Dr. Watson.

The subject of this first memoir was the varying luster of several of the stars, and especially that of Mira in the constellation of Cetus. It had been long known to fade in brightness from nearly that of a star of the first magnitude down to invisibility in such telescopes as then existed. Herschel had examined it, and many other variable stars, for himself; it was not, however, a simple or isolated phenomenon that engaged his attention; but, regarding the stars as so many suns, he examined stellar phenomena as possibly leading him to some intelligent conception of what might be occurring in our own sun. The sun, he knew rotated on its axis, and he knew that dark spots often exist on its photosphere; the questions that he put to himself were: Are there dark spots also on these variable stars? do the stars also rotate on their axes? or are they sometimes partially eclipsed by the intervention of some opaque and invisible bodies? And then he asked himself: What are these singular spots upon the sun? and have they any practical relations to us, the inhabitants of this planet? To these questions he applied his telescopes and his thoughts; and, as light from time to time dawned upon his apprehension, he communicated the results to the Royal Society in no less than six memoirs,

occupying many pages in the *Philosophical Transactions*, and extending in date from 1780 to 1801. It was in the latter year that these remarkable papers culminated in the inquiry whether any relation could be traced in the recurrence of sun-spots, regarded as evidences of solar activity (allied to volcanic), and the varying seasons of our planet, as exhibited by the varying price of corn. Herschel's solution of the question was scarcely final, and the question has recently cropped up again, with more than a renewal of its former interest.

In the following year (1781) he communicated to the Royal Society the first of a series of papers containing the results of his telescopic inquiries in relation to the rotation of the planets and of their several satellites. The object which he had in view was not so much to ascertain the velocities or times of their rotation, as rather to discover whether those rotations are strictly uniform. From the result he expected to gather, by analogy, the probability of an alteration in the length of our own day. These inquiries occupy the greater part of seven memoirs, extending from 1781 to 1797. In the course of these telescopic observations he lighted on the curious appearance of a white spot near to each of the poles of the planet Mars. On investigating the inclination of its axis to the plane of its orbit, and finding that it closely resembled that of our earth, he concluded that its changes of climate also would resemble our own, and that these white patches were probably polar snow. Modern investigations have confirmed his conclusions. He also discovered that, as far as his observations extended, the times of the rotations of the various satellites round their axes are in analogy with our own moon, viz., equal to the times of their revolution round their primaries. Here again we observe that his discoveries arise out of the complete and systematic and comprehensive nature of the investigation in which he is engaged. Nothing with such a man is accidental.

In the same year (1781) Herschel made a discovery which, as we shall see, soon completely altered the character of his professional life. In the course of his systematic examination of the heavens with a view to the discovery of the plan of their construction, he lighted on an object which at first he supposed to be a comet, but which, by its subsequent motions and appearance, turned out to be a new planet, moving outside of the orbit of Saturn. To this planet he in due time assigned the name of Georgium Sidus; but this name has by general consent been laid aside in favor of Uranus. It was discovered with a favorite seven foot reflector having an aperture of six and one-half inches; subsequently, when he had provided himself with a much more powerful telescope, of twenty feet focal length, he discovered what he believed to be no less than six satellites. Modern observations have shorn this gloomy planet of four of these supposed attendants, but at the same time have added two others apparently not observed by Herschel. No less than seven memoirs on the subject were communicated by him to the Royal Society, extending from the date of the discovery in 1781 to 1815. There is a peculiarity worthy of notice in Herschel's mode of observation which led to the discovery of this planet. He had observed that the spurious diameters of stars are not much affected by increasing the magnifying powers, but that the case is different with other celestial objects; hence if anything in his telescopic field attracted his notice by peculiarity of appearance, he immediately varied the magnifying power in order to decide the nature of the object. Thus Uranus was discovered; and had a similar method been applied to Neptune, that planet would have been discovered at Cambridge some months before it was recognized at Berlin.

We now come to the commencement of Herschel's most important series of observations, culminating in what ought probably to be regarded as his most capital discovery. A material part of the task which he had set himself as the work of his astronomical life embraced the determination of the relative distances of the stars from our sun and from each other. Now, in the course of his scrutiny of the heavens, he had observed many stars in apparently very close contiguity, but often greatly differing in their relative brightness. He concluded that, on the average, the brighter star would be the nearer to us, and the smaller enormously more distant. He considered that an astronomer on the earth, in consequence of its immense orbital displacement of some 180,000,000 of miles every six months, would see such a pair of stars under different perspective aspects; and this variety of perspective aspect observed and measured would, he thought, lead to an appropriate determination of their distance. With this view he mapped down the places and aspects of all the double stars that he met with, and communicated in 1782 and 1785 very extensive catalogues of the results. Indeed, the very last scientific memoir that he ever wrote, sent to the Royal Astronomical Society in the year 1822, at the time when he was its first president and in the eighty-fourth year of his age, related to these investigations. In the first of these memoirs he throws out the hint that these apparently contiguous stars must, if constituted after the material laws of our solar system, circulate round each other through the effects of gravitation; but he significantly adds that the time had not yet arrived for settling the question. Thus the philosopher abides his time in patience and confidence, and a dozen years afterward (1793) he remeasures the relative positions of many of these contiguous pairs, and we may conceive what his feelings must have been at finding the verification of his prediction. For he found that some of these stars had circulated round each other, after the manner required by the laws of gravitation. Thus Herschel had demonstrated the action of the same mechanical laws among the distant members of the starry firmament as bind together the harmonious motions of our solar system. This sublime discovery would of itself suffice to immortalize his memory in the respectful homage of all future races of intelligent men. If only Herschel had lived long enough to learn the approximate distances of some of these binary combinations, he would at once have been able to calculate their masses when compared with that of our own sun; and thus, knowing, as we now do, that these stars in their weights are strictly comparable with the weight of our own sun, he would have found another of his analogical conjectures realized.

In the year 1782, in consequence of his fame, Herschel was invited to Windsor by George III., and then accepted the offer made by the king to become his private astronomer, and henceforth devote himself wholly to a scientific career. The salary offered and accepted was £200 per annum, to which an addition of £50 per annum was subsequently made for the astronomical assistance of his faithful sister. In this way the great philosophical astronomer removed from Bath first to Datchet and soon afterward permanently to Slough, within the easy access of his royal patron at Windsor.

It was at Slough in 1783 that he wrote his first memorable paper on the *Motion of the Solar System in Space*—a sublime speculation, yet through his genius realized by considerations of the utmost simplicity. He returned to the same subject with fuller details in 1805. It was also after his removal to Slough that he published his first memoir containing his speculative ideas on the construction of the heavens, which from the first had

been the chief aim of his toils both of mind and body. In a long series of remarkable papers, addressed as usual to the Royal Society, and extending from the year 1784 to 1818, when he was eighty years of age, he demonstrated the fact that our sun is a star situated not far from the bifurcation of the Milky Way, and that all the stars visible to us lie more or less in clusters scattered throughout a comparatively thin stratum, but in the other two dimensions stretching immeasurably further into space. At one time he imagined that his powerful instruments had pierced through this stellar stratum of the Milky Way, and that he had approximately determined the form of some of its boundaries. In the last of his memoirs he had convinced himself of his error, and he admitted that to his telescopes our stratum of stars is "fathomless." Over this stratum of stars and their planetary attendants, the whole being in ceaseless motion round some common center of gravity as the resultant point of the combined gravitation, Herschel discovered on either side a canopy of discrete nebulous masses, from the condensation of at least a part of which the whole stellar universe had been formed—a magnificent conception, pursued with a force of genius and put to the practical test of observation with an industry almost incredible. It was the work of a single mind, carried to its termination with no assistance beyond that of a loyal sister, almost as remarkable a personage as himself.

Hitherto we have said nothing about that grand reflecting telescope, of forty feet focal length and four feet aperture, which is too often regarded as the chief effort of his genius and his perseverance. Gigantic as it really was, we are disposed to regard it as among the least of his great works. On the day that it was finished (August 28, 1789) Herschel saw at the first view, in a grandeur not witnessed before, the Saturnian system with all its six satellites, five of which had been discovered long before by Huygens or Cassini, while the sixth, latterly named Enceladus, he had, two years before, sighted by glimpses in his exquisite little telescope of six and one-half inches aperture, but now saw in unmistakable brightness with the towering giant he had just completed. On September 17th he discovered a seventh, which proved to be the nearest of all the satellites of Saturn. It has since that time received the name of Mimas. It is somewhat remarkable that, notwithstanding his long and repeated scrutinies of this planet, the eighth satellite, Hyperion, and the crape ring should have escaped him.

Herschel married the widow of Mr. John Pitt, a wealthy London merchant, on May 8, 1788, by whom he had an only son, John Frederick William. The prince regent conferred a Hanoverian knighthood upon Herschel in 1816. But a far more valued and less tardy distinction was the Copley medal assigned to him by his associates in the Royal Society in 1781. He died at Slough on August 25, 1822.

HERSCHEL, SIR JOHN FREDERICK WILLIAM, BART., the only son of Sir F. William Herschel, was born at Slough, Bucks, in 1792. His scholastic education commenced at Eton. Thence, at the early age of seventeen, he was sent to St. John's College, Cambridge, and the form and method of the mathematical instruction he there received exercised a material influence on the whole complexion of his scientific career. In due time the young student acquired the highest academical distinction of his year, graduating as senior wrangler. Two or three memoirs communicated to the Royal Society on new applications of mathematical analysis at once placed him in the front rank of the cultivators of this branch of knowledge. Of these his father had the gratification of introducing the first, but the others were presented in his own right as a fellow,

His first intention had been to study for the bar, and with this view he left the university, and placed himself under the guidance of an eminent special pleader of that day, but an early acquaintance with Doctor Wollaston in London soon changed the direction of his studies. In 1820, assisted by his father, he completed a mirror of eighteen inches diameter and twenty feet focal length, for a reflecting telescope. This, subsequently improved by his own hands, became the instrument which enabled him to effect the astronomical observations which, more than any other of his great works, form the basis of his fame. In 1821–23 we find him associated with Mr. South in the reëxamination of his father's double stars, by the aid of an achromatic telescope and other appliances, the like of which for excellence and power had not hitherto been collected. For this work in 1826 he received the recognition of the Astronomical Society by the award of their gold medal; the French Institute also presented him with the Lalande medal for the same contribution to astronomical science. In 1821 the Royal Society presented him with the Copley medal for his mathematical contributions to their *Transactions*. From 1824 to 1827 he held the distinguished and responsible post of secretary to that society. In 1827 he was elected to the chair of the Astronomical Society, which office he also filled on two subsequent occasions. In 1831 the honor of knighthood was conferred on him by William IV., and two years later he again received the recognition of the Royal Society by the award of one of their medals for his memoir *On the Investigation of the Orbits of Revolving Double Stars*.

Before the end of the year 1833, being then about forty years of age, Sir John Herschel had reëxamined all his father's discoveries of double stars and nebulae, and had added many similar bodies to his own list; this alone constituted a gigantic work even for the lifetime of any astronomer in that day. For it should be remembered that the astronomer was not as yet provided with those curious and valuable automatic contrivances for observing and for recording observations which at present most materially abridge the labor and increase the accuracy of astronomical work such as that in which Sir John had been engaged. And he had no assistant. Equatorial clocks for turning the telescope, electrical chronographs for recording the times of the phenomena observed, were at that date unknown.

His scientific life now entered another and very characteristic phase. The bias of his mind, as he subsequently was wont to declare, was toward chemistry and the phenomena of light, rather than toward astronomy. Indeed very shortly after taking his academical degree at Cambridge, he proposed himself as a candidate for the vacant chair of chemistry in that university; but, as he said with some humor, the result of the election was that of the votes he had a glorious minority of one. In fact Herschel had become an astronomer from a sense of duty, just as his father had become one by fascination and fixed resolve; hence it was by filial loyalty to his father's memory that he was now impelled to undertake the completion of that work which at Slough had been so grandly commenced. William Herschel had explored the northern heavens; John Herschel determined to explore the heavens of the south, as well as reëxplore the north. In accordance with this resolution, he and his family embarked for the Cape on November 13, 1833; they arrived in Table Bay on January 15, 1834.

To give an adequate description of the vast mass of labor completed during the next four busy years of his life at Feldhausen would require the transcription of a considerable portion of the *Cape Observations*, a volume which probably is not surpassed in varied interest or astronomical importance by any scientific work in exist-

ence. Herschel returned to his English home in the spring of 1838. As was natural and honorable to all concerned, he was welcomed with an enthusiastic greeting. By the queen at her coronation he was created a baronet.

Herschel was a highly accomplished chemist. His discovery of the solvent power of hyposulphite of soda on the otherwise insoluble salts of silver, in 1819, exercised a most important influence on the practical application of photography twenty years afterward; and in 1839, the natal year of that valuable art, he, independently of Mr. Fox Talbot, had discovered the means of taking and multiplying photographic pictures, and early in the spring of that year exhibited more than twenty photographic pictures to the Royal Society, including one of the old forty-foot telescope. He was the first person to introduce the now well-known terms *positive* and *negative* in photographic images, and to deposit upon glass a sensitized film for the reception of the picture. He also paved the way for Professor Stokes' important discovery of the change which luminous waves may suffer in their period of oscillation, by his addition of the lavender rays to the spectrum, and by his announcement of "epipolic dispersion," as exhibited by sulphate of quinine. Several other important and successful researches of his, connected with the undulatory theory of light, are scattered through the pages of his treatise on "Light" published in the *Encyclopædia Metropolitana*.

The main work of his declining years was the collection of all his father's catalogues, combined with his own observations and those of other astronomers of nebulae and double stars, each into a single volume. He lived to complete the former, and to present it to the Royal Society, who have published it in a separate form in the *Philosophical Transactions*. The latter work he had not fully completed at his death; but he bequeathed as much of it as was finished to the Astronomical Society. That society has printed a portion of it, which serves as an index to the observations of various astronomers on double stars up to the year 1866.

A complete list of his various contributions to learned societies will be found in the Royal Society's great catalogue, and from them may be gathered most of the records of his busy scientific life. Sir John Herschel met with an amount of public recognition which was unusual in the time of his illustrious father. Naturally he was a member of almost every important learned society in both hemispheres. For five years he held the office of master of the mint, the same appointment which, more than a century before, had been occupied by Sir Isaac Newton.

Herschel died at Collingwood, his residence near Hawkhurst in Kent, May 11, 1871, in the seventy-ninth year of his age, and his remains are interred in Westminster Abbey close to the grave of Sir Isaac Newton.

HERSENT, LOUIS, French painter, was one of David's most distinguished pupils, and became one of the most noted painters of the Restoration. He was born at Paris on March 10, 1777, and obtained the Prix de Rome in 1797; in the Salon of 1802 appeared his *Metamorphosis of Narcissus*, and he continued to exhibit with rare interruptions up to 1831. His most considerable works under the empire were *Achilles Parting from Briseis*, and *Atala Dying in the Arms of Chactas*; an *Incident of the Life of Fénélon*, painted in 1810, found a place at Malmaison, and *Passage of the Bridge at Landshut*, which belongs to the same date, is now at Versailles. Hersent's typical works, however, belong to the period of the Restoration. He continued in favor under Charles X., for whom was executed *Monks of Mount St. Gotthard*, exhibited in 1824. In 1831

Hersent made his last appearance at the Salon with portraits of Louis Philippe, Marie-Amélie, and the duke of Montpensier. After this date Hersent ceased to exhibit at the yearly salons. Although in 1846 he sent an excellent likeness of Delphine Gay, and one or two other works to the rooms of the Société d'Artistes, he could not be tempted from his usual reserve even by the international contest of 1855. Five years later, on October 2, 1860, he died.

HERSFELD, a town of Prussia, capital of a circle in the government district of Cassel, province of Hesse-Nassau, is situated at the confluence of the Geisa and Haune with the Fulda, ten miles north northeast of Fulda. Population (1890), 8,000.

HERSTAL, or in its older form HERISTAL, a market-town of Belgium, on the left bank of the Meuse, three or four miles northeast of Liège, and skirting the road which leads from that city to Maestricht. Its population, which numbers 11,126, is mainly supported by its coal mines and iron industries.

HERTFORD, or HERTS, an inland county of England, lying north of Middlesex, south of Cambridge-shire and Bedfordshire, and west of Essex. Its area is 405,141 acres, all highly cultivated land, the county being about equally divided between pasture and arable farms. It is watered by numerous small streams, from three of which, the Lea, the Colne, and the New river (the latter an artificial conduit) part of the London water supply is obtained. The subdued beauty of the landscape and its contiguity to London have rendered this county for many years a favorite residential district, and it contains hundreds of country-seats of the nobility. It is well wooded and produces the best wheat in England. Much of the land is used as market gardens, and orchards are plentiful.

Farms average about 200 acres in extent, and cultivation is carried on with all modern improvements. Hertfordshire is traversed by four great trunk lines of railroad, the Great Eastern, Great Northern, Midland, and London & Northwestern. The old Roman roads to York, to St. Albans and Bedford, and to Warwick cross it, and its highways are among the best in the kingdom. The Grand Junction canal passes through its southwestern border and furnishes with its feeder, the Colne river, waterpower for hundreds of flour-mills. Hertfordshire contains numerous breweries, tanneries, tile works, and carriage factories. Its principal manufactures are, however, silk, paper, and straw plait.

The county town is Hertford, population, 8,000. Other towns, ranging from 9,000 to 4,000, are St. Albans, Hitchin, Watford, Bishop Stortford, Hemel-Hempstead, Ware, Berkhamstead, Tring, and Barnet. The county returns three members to parliament, and the borough of Hertford sends one. The population in 1889 was 203,069.

Hertfordshire is one of the most interesting counties in England to the antiquary. Verulamium (now St. Albans) was the capital of the Cassii, whose chief, Cassivelaunus, was defeated by Cæsar 54 B.C., and numerous Roman earthworks are still visible. St. Alban, the proto-martyr of Britain, suffered death at the city named after him, and the abbey, still in magnificent preservation, was founded in 793 A.D. During the Wars of the Roses two great battles were fought at St. Albans, and at Barnet the earl of Warwick was defeated by Edward IV. Francis, Lord Bacon, lived at Gorhambury; Queen Elizabeth at Hatfield House, the present seat of the marquis of Salisbury; William Cowper at Berkhamstead, and Lord Lytton at Knebworth.

HERTZ, HENRIK, Danish poet, was born of Jewish parents in Copenhagen, August 25, 1798. At that date it was unusual for Jews to enjoy a professional educa-

tion, but young Hertz showed such marked literary bias that in 1817 he was sent to the university. Young Hertz was destined for the law, and passed his juridical examination in 1825. But his taste was all for polite literature, and in 1827 he came forward as a dramatic author by the publication of two plays, *Herr Burchardt and his Family* and *Love and Policy*; the latter enjoyed considerable success on the stage. In 1828 followed the comedy of *Flyttedagen*. In 1830 he brought out a complete novelty in Danish literature, a drama in rhymed verse, *Amor's Strokes of Genius*. In the same year Hertz published anonymously *Gjengangerbrevene*, or Letters from a Ghost, which he pretended were written by Baggesen, who had died in 1826, and which were full of satirical humor and fine critical insight. The success of this book was overwhelming; Copenhagen talked of nothing else for a whole season; but Hertz preserved his anonymity, and the secret was not known until many years later. In 1832 he published a didactic poem, *Nature and Art*, and *Four Poetical Epistles*. *A Day on the Island of Als* was his next comedy, followed in 1835 by *The Only Fault*. In 1836 his comedy of *The Savings Bank* enjoyed a great success. But it was not till 1837 that he developed his most important talent by writing the romantic drama of *Svend Dyrring's House*, a beautiful and original piece, which still holds the stage. His historical tragedy *Valdemar Atterdag* was not so well received in 1839; but in 1845 he achieved an immense success with his lyrical drama, *King René's Daughter*, which has been translated into almost every European language, and successfully acted all over the civilized world. To this succeeded the tragedy of *Ninon* in 1848, the romantic comedy of *Tonietta* in 1849, *A Sacrifice* in 1853, *The Youngest* in 1854. His lyrical poems appeared in successive collections, dated 1832, 1840 and 1844. From 1858 to 1859 he edited a very interesting literary journal entitled *Weekly Leaves*. He died in 1870.

HERTZEN, ALEXANDER, celebrated Russian author, was born at Moscow in 1812, a very short time before the occupation of that city by the French. In 1813 the family returned to Moscow, where Herzen passed his youth—remaining there, after completing his studies at the university, till 1834, when he was arrested and tried on a charge of having assisted at a festival during which verses by Sokolovsky, of a nature uncomplimentary to the emperor, were sung. A special commission found him guilty, and in 1835 he was banished to Viatka. There he remained till the visit to that city of the hereditary grand duke (afterward Alexander II.), accompanied by the poet Joukofsky, led to his being allowed to quit Viatka for Vladimir, where he was appointed editor of the official gazette of that city. In 1840 he obtained a post in the ministry of the interior at St. Petersburg; but in consequence of having spoken too frankly about a death due to a police officer's violence, he was sent to Novgorod, where he led an official life, with the title of "state councilor," till 1842. In 1846 his father died, leaving him by his will a very large property. Early in 1847 he left Russia, never to return. From Italy, on hearing of the revolution of 1848, he hastened to Paris, whence he afterward went to Switzerland. In 1852 he quitted Geneva for London, where he settled for some years. In 1864 he returned to Geneva, and, after some time went to Paris, where he died, January 21, 1870.

His literary career began in 1842 with the publication of an essay, in Russian, on *Dilettantism in Science*, under the pseudonym of "Iskander," the Turkish form of his Christian name. His second work, also in Russian, was his *Letters on the Study of Nature* (1845-6). In 1847 appeared his novel *Kto Vinovat?*

(Whose fault?) From a literary point of view his most important work is *Kto Vinovat?* a story describing how the domestic happiness of a young tutor, who marries the unacknowledged daughter of a Russian sensualist of the old type, dull, ignorant, and genial, is troubled by a Russian sensualist of the new school, intelligent, accomplished and callous, without there being any possibility of saying who is most to be blamed for the tragic termination. But it was as a political writer that Herzen gained the vast reputation which he at one time enjoyed. Having founded in London his "Free Russian Press," of the fortunes of which, during ten years, he gave an interesting account in a book published (in Russian) in 1863, he issued from it a great number of Russian works, all leveled against the system of government prevailing in Russia. Herzen's writings, and the journals he edited, were smuggled wholesale into Russia, and their words resounded throughout that country, as well as all over Europe. Their influence became overwhelming. Evil deeds long hidden, evil-doers who had long prospered, were suddenly dragged into light and disgrace. His bold and vigorous language aptly expressed the thoughts which had long been secretly stirring Russian minds, and were now beginning to find a timid utterance at home. For some years his influence in Russia was a living force, the circulation of his writings was a vocation zealously pursued. When the Polish insurrection of 1863 broke out, and he pleaded the insurgents' cause, his reputation in Russia received its death-blow. From that time it was only with the revolutionary party that he was in full accord, and it is by that section of Russian Liberals alone that his opinions are now considered of authority.

HERULI, ÆRULI, or ERULI, a nomadic and warlike German tribe who inhabited the northern shores of the Black Sea, but afterward divided into various sections and wandered into different parts of Europe. They made their first appearance in history in the third century, as taking part with the Goths in their incursions against the eastern provinces of the Roman empire. In the fourth century they acknowledged the overlordship of the Gothic king Ermanric, but when Attila, king of the Huns, made his descent upon Gaul, they joined his standard. After the overthrow of the Huns, in which they suffered considerably, they established an organized and distinct confederacy on the banks of the Danube, and under the leadership of Odoacer, assisted in 476 in the overthrow of the Western empire. About the end of the sixth century they became submerged and lost in other nations, and disappeared from historical records.

HERVEY, JAMES, a popular religious writer of the eighteenth century, was born in England, near Northampton, February 26, 1714, and was educated at the grammar school of Northampton, whence in 1731 he passed to Lincoln College, Oxford. At the university he came under the influence of John Wesley and others of that school, and for some time manifested an inclination toward their theology; ultimately he adopted a thoroughly Calvinistic creed, and resolved to retain connection with the Established Church. Having taken holy orders in 1737, he became curate to his father in the family livings of Weston Favell and Collingtree, to which he himself succeeded in 1752. He wrote numerous religious works, which, though of but slight literary or theological value, rapidly became highly popular, and in many English and Scottish houses, especially of the humbler class, took a place on the same shelf with the *Pilgrim's Progress* and the *Whole Duty of Man*. His earliest work, *Meditations and Contemplations*, containing "Meditations Among the Tombs," "Reflections

on a Flower Garden," and a "Descant on Creation" (1746), and "Contemplation on the Night and Starry Heavens" (1747), said to have been modeled on Boyle's *Occasional Reflections on Various Subjects*, within fourteen years passed through as many editions. Hervey died on December 25, 1758.

HERVEY, JOHN HERVEY, LORD, the "Narcissus," "Sporus," and "Lord Fanny" of Pope's satire, a nobleman of political and social distinction in the reign of George II., was son of John, first earl of Bristol, and was born on October 13, 1696. Educated and trained for public life at Westminster and Clare Hall, Cambridge, he became a favorite of the court of the prince and princess (afterward George II. and Queen Caroline), to which Pope, Gay, Arbuthnot, Chesterfield, and other wits resorted, and which was celebrated for the beauty and accomplishments of its ladies, such as Miss Bellenden (afterward duchess of Argyle), Miss Howe, Miss Lepell, and Mrs. Howard, whose names will live forever in the poetry of Pope, Gay and Swift, and in the lively memoirs and correspondence of that brilliant circle. Hervey was married to Miss Lepell in 1720. Having entered the House of Commons as member for Bury (1725), he in 1730 received the appointment of vice-chamberlain to the king; in 1733 Sir Robert Walpole called him up to the House of Lords, where he proved a frequent and effective speaker; and in 1740 he succeeded Lord Godolphin as lord privy seal, which office he held until the Walpole administration was driven from power in 1742. Notwithstanding miserable health he continued to take an active part in politics until his death, which occurred on August 8, 1743. Lord Hervey was far above the intellectual rank assigned him by his merciless satirist, Pope. He wrote and spoke vigorously on public questions, was studious and laborious, a fair scholar, and a writer of pleasing occasional verses. The origin of the hostility which led to the allusion in the *Dunciad* (iv. 104) in 1728, and afterward to the attacks in the *Prologue* and *Epilogue to the Satires*, remains obscure.

HERZEGOVINA, an Illyrian province, ethnographically belonging to the Serbo-Croatian nationality, under the titular dominion of the Turkish sultan, but since 1878 administered by Austria-Hungary. The Turks included it in the vilayet of Bosnia. It is bounded north and east by Bosnia, south by Montenegro, and west by Dalmatia, only touching the Adriatic by the narrow enclaves of Klek and Suttorina. By the treaty of Berlin the Herzegovinian districts of Niksich and Dormitor have been placed under the government of the prince of Montenegro.

According to Roskiewicz the population of Herzegovina amounted in 1868 to 230,000 souls. Klaich, however, the most recent Slavonic authority on the province (1878), reduces the population to 185,421. During the troubles that ensued on the insurrection of 1875, about two-thirds of the Christian population fled beyond the Dalmatian and Montenegrin border, and the fearful mortality among these refugees largely diminished the Herzegovinian population. With the exception of the Gipsies, the Jews, and a small sprinkling of Osmanli officials, the whole population is Slavonic, the Mohammedans being for the most part renegade descendants of the feudal nobility that had formed itself here before the Turkish conquest. Much of the old Slavonic customs and family life still holds among the Herzegovinian Mussulmans, and here, as in Bosnia, polygamy is unknown.

The Serbo-Croatian language is spoken in its purest form in Herzegovina, and the Narenta valley has been called the Serbian Val d'Arno. The Orthodox Greek population is chiefly settled in the district east of the

Narenta; to the west of that river the population is mostly Roman Catholic, and the Mahometans inhabit the larger towns. Mostar, the capital, has a population of 30,000. Of the other towns, Ljubuski has, according to Klaich, a population of about 3,000 souls, Stolat, 3,500; Focha, 10,000; Niksich (now under Montenegro), 4,000; and Trebinje, 3,000.

Herzegovina, which has been described as the Turkish Switzerland, is divided into a variety of mountain plateaus by the parallel ranges of the Dinaric Alps; and the whole country is bisected by the river Narenta, which cleaves its way through the mountains from the Bosnian frontier toward the Adriatic. The valley of the Narenta and its tributaries forms the main artery of the province. There is situated the capital, Mostar; and a fine highroad, the only avenue of communication between Serrajevo (Bosna Serai) and the Adriatic, follows the river bank from the Dalmatian frontier to the Bosnian. The climate of Herzegovina is cold in winter and oppressively hot in summer. The sirocco is a prevalent wind, as well as the bora, the fearful north-northeaster of Illyria, which, sweeping down the lateral valleys of the Dinaric Alps, overwhelms everything in its path. The snow-fall is slight, and, except on a few of the loftier peaks, the snow soon melts. In the valleys, as that of the Narenta, the flora approaches that of Dalmatia and Southern Italy, and olives, mulberries, figs, melons, pomegranates, grapes, rice and maize flourish.

Herzegovina became a duchy in 1440, and was ultimately subject to the Turks, Venetians and Austrians during several hundred years. In July, 1875, the native population rose against their Turkish masters, and thus precipitated the Russo-Turkish war. By the treaty of Berlin the government of Bosnia and Herzegovina was confided to Austria, which now exercises suzerainty over the principalities. But the Turkish Sultan still claims sovereignty.

HERZOGENBUSCH, or HERTOGENBOSCH. See BOIS-LE-DUC.

HESEKIEL, GEORGE LOUIS, German author and journalist, was born August 12, 1818, in Halle. Hese-kiel studied history and philosophy in Halle, Jena and Berlin, and devoted himself in early life to journalism and literature. In 1848 he settled in Berlin, where he died, February 26, 1874. He achieved a considerable reputation both as a writer of books and as editor of the *Neue Preussische Zeitung*.

HESIOD, the father of didactic poetry in Greece, is placed by Herodotus after Homer, but not more than 400 years before his own epoch; and, though the settlement of the question must depend on the internal evidence of the Hesiodic poems, this testimony is corroborated by the Parian marble and the historian Ephorus. He probably flourished about nine centuries before Christ. His father had migrated from Cyme in Æolia to Bœotia, exchanging there a seafaring life for agriculture; and Hesiod and his brother, a scapegrace named Perses, were born at Ascra, near the base of Helicon and under the mountains which encircle Bœotia. His earliest poem, the famous *Works and Days*, embodies the experiences of his life afield, and, interwoven with episodes of fable, allegory and personal history, forms a sort of Bœotian shepherd's calendar. The connecting link of the whole poem is the author's advice to his brother, who appears to have bribed the corrupt judges to deprive Hesiod of his already scanty inheritance, and to whom, as he wasted his substance lounging in the agora, the poet more than once returned good for evil, though he tells him there will be a limit to this unmerited kindness. In the *Works and Days* the episodes which rise above an even didactic level are the *Creation and Equipment of Pandora*, the *Five*

Ages of the World and the much-admired *Description of Winter* (by some critics judged post-Hesiodic).

The other poem attributed to Hesiod or his school which has come down in great part to modern times is *The Theogony*, a work of grander scope, inspired alike by older traditions and abundant local associations. With the poet's history, apart from the evidence of his poems, we have little acquaintance. There is reason to suppose that in later life he removed from Ascra to Orchomenus, where, according to Pausanias, were his sepulcher and epitaph. Tradition has assigned a tragical ending to a life seemingly placid and unemotional; but the story that he met a violent death near the Locrian Ceneon in the territory of Naupactus, by reason of an intrigue with a sister of his host, or a guilty knowledge of such intrigue, is probably valueless except as evidence of the hero-worship of Hesiod in Locris and Bœotia.

HESPERIDES, maidens whose number is variously given as three, four, or seven, who guarded the golden apples which Earth gave Hera at her marriage to Zeus. They live far away in the west at the borders of Ocean, in other words at that point of heaven where the sun sets. Heracles is the hero who brings back the golden apples to mankind again. Like Perseus, he first applies to the Nymphs, who help him to learn where the garden is. Arrived there he slays the dragon and carries the apples to Argos; and finally, like Perseus, he gives them to Athene. The Hesperides are, like the Sirens, beautiful singers. They are said to be the daughters of Atlas; or, according to other accounts, they are the children of Erebus and Night, or Phorcys and Ceto, and are thus sisters of the Grææ, who also receive into their care the setting sun.

HESS. Among numerous German artists of this name, the following particularly deserve attention.

HEINRICH MARIA HESS—Von Hess, after he received a patent of personal nobility—was born at Düsseldorf in 1798, and brought up to the profession of art by his father, the engraver Karl Ernst Christoph Hess. Karl Hess had already acquired a name when in 1806 the elector of Bavaria, having been raised to kingship by Napoleon, transferred the Düsseldorf academy and gallery to Munich. In 1828 he was made professor of painting and director of all the art collections at Munich. He decorated the Aukirche, the Glyptothek, and the Allerheiligencapelle at Munich with frescoes; and his cartoons were selected for glass windows in the cathedrals of Cologne and Ratisbon. Then came the great cycle of frescoes in the basilica of St. Boniface at Munich, and the monumental picture of the *Virgin and Child* enthroned between the four doctors, and receiving the homage of the four patrons of the Munich churches (now in the Pinakothek). His last work, the *Lord's Supper*, was found unfinished in his atelier after his death in 1863.

PETER HESS—afterward von Hess—was born at Düsseldorf in 1792, and accompanied his younger brother Heinrich Maria to Munich in 1806. He became a painter of skirmishes and battles. In 1813–15 he was allowed to join the staff of General Wrede, who commanded the Bavarians in the military operations which led to the abdication of Napoleon. In the course of years he successively visited Austria, Switzerland, and Italy. On Prince Otho's election to the Greek throne King Louis sent Peter Hess to Athens to gather materials for pictures of the war of liberation. The sketches which he then made were placed, forty in number, in the Pinakothek, after being copied in wax on a large scale (and little to the edification of German feeling) by Nilsen, in the northern arcades of the Hofgarten at Munich. He died suddenly at Munich in April, 1871.

KARL HESS, the third son of Karl Christoph Hess, born at Düsseldorf in 1801, was also taught by his father, who hoped that he would obtain distinction as an engraver. Karl, however, after engraving one plate after Adrian Ostade, turned to painting under the guidance of Wagenbauer of Munich, and then studied under his elder brother Peter. But historical composition proved to be as contrary to his taste as engraving, and he gave himself exclusively at last to illustrations of peasant life in the hill country of Bavaria. He died at Reichenhall on November 16, 1874.

HESSE, or HESSIA (in German *Hessen*), an old country of Germany, situated on both banks of the Rhine and Main, north and south of Frankfort, has had different boundaries at different times. Its greatest length was about ninety-five miles, while its breadth has varied considerably. Several detached portions of territory were also included in Hesse.

Till the death of Philip the Magnanimous in 1567, Hesse continued to be regarded as one state, though sometimes shared by two rulers; but at that date Philip's four sons divided the landgraviate into Hesse-Cassel, Hesse-Marburg, Hesse-Rheinfels, and Hesse-Darmstadt. Of these the second and third lapsed by inheritance in 1583 and 1604 to the others, which became the chief lines. The small landgraviate of Hesse-Homburg was formed in 1596 of part of Hesse-Darmstadt. Hesse-Darmstadt, since the annexation of the other two to Prussia in 1866, has been the only independent part of Hesse left, and generally receives the common name. Hesse-Nassau is a province of Prussia, formed in 1866 from parts of Hesse-Cassel and the dukedom of Nassau. Hesse-Philippsthal was a collateral line of the house of Hesse-Cassel, founded in 1630, and extinct in 1820. Hesse-Barchfeld, Hesse-Butzbach, Hesse-Rothenburg, Hesse-Rumpenheim, and Hesse-Wanfried, were collateral lines of little importance.

HESSE-CASSEL, in German KURHESSEN, *i.e.*, Electoral Hesse, now forming the government district of Cassel in the Prussian province of Nassau, was, till 1866, a landgraviate and electorate of Germany, consisting of several detached masses of territory, to the northeast of Frankfort-on-the-Main. It contains a superficial area of 3,699 square miles, and population of (1889) 975,550.

HESSE-DARMSTADT, GRAND-DUCHY OF, the actual Hesse of the present day, is a state of Germany situated on the Rhine and Main, between Prussia on the north and Baden on the south. It consists of two large and several small detached portions of territory. The more northerly of the large portions forms the province of Oberhessen, and is completely surrounded by Prussia. The other, divided by the Rhine into the provinces of Starkenburg and Rheinhessen, is bounded on the north by Hesse-Nassau, on the west by the Rhine Palatinate and Rhenish Prussia, on the south by Baden, and on the east by Baden and Bavaria. The extent of the duchy is about 2,965 square miles. Oberhessen is mountainous, having the Vogelsberg in the east with Taufstein (2,579 feet) as the highest summit in the country, and the Hausberg, a branch of the Taunus, in the southwest. The chief rivers are the Rhine, Main, Neckar, Lahn, and Fulda, with their tributaries. There are no lakes, but mineral springs abound in all the provinces. Agriculture, including the breeding of horses and cattle, is actively encouraged by government, and is the principal industry of the people. Forestry and vine-growing are also important, the latter being practiced almost exclusively in Rheinhessen. The principal crops are millet, buckwheat, oats, and potatoes; but rape (for oil), hemp, flax, tobacco, and fruit are also cultivated. The manufactures embrace leather

(enameled and colored), tobacco, cigars, shoes, furniture, pocket-books, and similar goods, chemicals, matches, machinery, and various textile fabrics. Mining is carried on chiefly in Oberhessen. Iron, copper, manganese, graphite, lignite, salt, marble, and clay are the principal minerals, which are worked for home consumption. There is a university at Giessen, and the schools, ordinary, technical, and theological, throughout the country are very numerous. The Protestant religion predominates, though the Roman Catholic faith is also recognized by the state. Darmstadt is the capital; Offenbach is the chief manufacturing town; Mainz has perhaps the most active trade. The other chief towns are Alsfeld, Lauterbach, Friedberg, Bingen, Bensheim, and Worms. Population (1889), 980,500.

HE SSE-HOMBURG, a former landgraviate of Germany, consisted of two parts, the province of Homburg-vor-der-Höhe, on the right bank of the Rhine, and the lordship of Meisenheim (added in 1815), on the left bank, to the north of Frankfort-on-the-Main. Homburg now forms part of the Prussian government district of Wiesbaden, and Meisenheim of the government district of Coblenz. Population, 35,000.

HESSIAN FLY, a name originally given in the United States in 1776 during the War of Independence to a small fly very destructive to wheat, supposed to have been brought over in straw by the Hessian troops employed on the British side. It is a species of *Cecidomyia*, described under the name *C. destructor* by the American entomologist Say, and belonging to the Dipterous family *Cecidomyiidae*, the numerous members of which produce galls, distortions, and other injuries in the plants they attack. It was often thought that this insect occurred in England; but the indigenous English wheat-midge, also very destructive, is an allied species, *Diplosis tritici*. A species found in Hungary and Germany, where it has committed great damage, has been supposed to be the true Hessian fly, which has also been recorded from Minorca and Naples. Nevertheless, many good authorities have considered that the destructive European fly is not identical with the North American insect, though closely allied to it, and of similar habits. In the United States this minute midge has been a dreadful scourge at times, even to the extent of causing local famine. The female lays twenty or thirty eggs in a crease of the leaf of the young plant, and the larvæ when hatched work their way between the leaf and the stalk, till they come to a joint, a little below the surface, where they remain, head down, sucking the sap, and turn to pupæ inclosed in a covering; this is known as the "flax-seed" condition. The injury occasioned is not detected until the plant grows higher. There are two broods every year, one reaching the fly state in May, the other in August or early in September; as the fly only lives a few weeks, wheat that is sown so late as not to come up until the second brood has disappeared escapes harm. The usual result of the attack is that small aborted ears only are formed, the few grains of which shrivel and will scarcely ripen, the straw also being of inferior quality. The perfect insect is smaller than the common gnat, which it somewhat resembles, and from which its size and more simple antennæ distinguish it. The larvæ are spindle-shaped and reddish-white, with the intestinal canal showing through the skin when full grown; they are about one-seventh of an inch long, and are provided with small hooks near the head; at this stage they group themselves in regular rings round the stem attacked.

HESSUS, HELIUS EOBANUS, a distinguished German humanist of the sixteenth century, was born January 6, 1488, at Bockendorf, near Frankenberg, in Hesse, and died in 1540.

HESTIA, a Greek goddess, who is probably the latest in origin of the greater deities. She seems to belong to a particular stage in the advance of civilization, and to embody the religious sanction that confirmed the social system then reached. She is not mentioned in Homer; in the *Odyssey* sometimes one swears by Zeus, the table and the hearth, *i.e.*, by Zeus as the god of the family, both in its external relation of hospitality and its internal unity round its own hearth. We find in Hestia relics of the old pre-Greek worship; she is the altar-fire, presiding over all sacrifices, and sharing in the honors of all the gods. The opening sacrifice was offered to Hestia; to her at the sacrificial meal the first and the last libations were poured. The fire of Hestia was always kept burning, or if by any mischance it were extinguished, only sacred fire made by friction, or got direct from the sun, might be used to rekindle it. But beyond this she is the goddess of the family union, the personification of the idea of home, the protectress along with Zeus of the suppliants who fled for refuge to the hearth. To her, therefore, is ascribed the art of housebuilding. Hestia and Hermes are often united as the representatives of home and private life on the one hand, and of all business and outdoor life on the other.

HESYCHASTS, a quietistic sect which arose among the monks of the Greek Church, and especially of Mount Athos, during the later period of the Byzantine empire, and owing to various adventitious circumstances came into great prominence politically and ecclesiastically for a few years about the middle of the fourteenth century.

HESYCHIUS was a grammarian of Alexandria, as we learn from a letter prefixed to his great work. From the fact that he was apparently unknown to Hesychius the Milesian and other writers of the time of Justinian, M. Schmidt considers that he must have flourished later than 530 A.D. On the other hand he cannot have been later than 642 A.D., when the school of Alexandria was scattered by the Saracen conquest.

HETTSTÄDT, or HETTSTEDT, a town of Prussian Saxony, in the circle of Mansfeld, and the government district of Merseburg, is situated on both banks of the Wipper, about twenty-three miles northwest of Halle. Population, 6,000.

HEUGLIN, THEODOR VON, an eminent African and Arctic traveler, was born March 20, 1824, at Hirschlanden near Leonberg in Würtemberg, and died at Stuttgart, November 5, 1876. Supplied with funds by his mother's liberality, Heuglin went to Egypt in 1851, and till 1865 the northeastern regions of Africa were the main scene of his labors. In 1852 he accompanied Doctor Reitz, the Austrian consul at Khartum, in his fatal journey to Abyssinia; in 1853, having been appointed Doctor Reitz's successor in the consulate, he visited Kordofan and the lower course of the White Nile; and in 1857, on his return after about two years' absence in Europe, he was commissioned by the grand-duke Ferdinand Maximilian of Austria to explore the countries along the west coast of the Red Sea. From the latter part of 1858 to the latter part of 1860 he was again in Europe; but in 1861 he was placed at the head of the Vogel search expedition, which included Munzinger, Steudner, Kinzelbach, etc., and was expected to make its way to Wadai. Having reached Mai-schecha, the explorers broke up into three parties, Heuglin turning along with Steudner and Schubert in the direction of Adoa, Gondar, and the Galla lands. At Khartum they joined Miss Tinne's party, and proceeded to Lake Rey and the Kosanga river, but Steudner died on April 10, 1863, and Heuglin was compelled by sickness to retrace his steps. He returned to Europe in 1865. In 1870 and 1871 he made a valuable series of explorations in Spitzbergen and

Novaya Zemlya; but 1875 found him again in North-east Africa, in the country of the Beni Amer and Habab. An invitation from the khedive took him abroad again in 1876, but receiving no definite appointment he returned to Europe. Later in the same year he was engaged in preparing for an exploration of the island of Socotra, when he was suddenly carried off by inflammation of the lungs.

HEUSCH, WILLEM or GUILLIAM DE, a landscape painter in the seventeenth century at Utrecht. The dates of this artist's birth and death are unknown. Nothing certain is recorded of him except that he presided over the guild of Utrecht, while Cornelis Poelemburg, Jan Both, and Jan Weenix formed the council of that body, in 1649. According to the majority of historians, Heusch was born in 1638, and was taught by Jan Both.

HEVELIUS, HEVEL, HEWEL, HEWELKE, or HÖVELKE, JOHANN, astronomer, was born at Dantzic on January 28, 1611, and died there on January 28, 1687.

HEXHAM, a market-town of England, county of Northumberland, is situated on the south bank of the river Tyne, crossed there by a handsome stone bridge of nine arches, twenty miles west from Newcastle and thirty-six east from Carlisle, and on the line of railway connecting those towns. Population, 8,000.

HEYDEN, JAN VAN DER, was born at Gorcum in 1637, and died at Amsterdam on September 12, 1712. He was an architectural landscape painter, a contemporary of Hobbema and Jacob Ruysdael, with the advantage, which they lacked, of a certain professional versatility; for while they painted admirable pictures and starved, he varied the practice of art with the study of mechanics, improved the fire engine, and died superintendent of the lighting and director of the firemen's company at Amsterdam.

HEYDUKE. See HAJDUK.

HEYLIN, PETER (1599-1662), an historical and polemical writer, born in England, November 29, 1599. Heylin was entered at Hart Hall, Oxford, in 1613; was of Magdalen College, 1615; B.A., July, 1617; M.A., 1620; B.D., 1629; D.D., 1633. In July, 1618, he began to read college lectures on cosmography (*i.e.*, geography) with such acceptance that his associates made him fellow of Magdalen. The lectures, under the title of *Microcosmos*, were published in 1621; and many editions of this useful book, each somewhat enlarged, subsequently appeared, until scarcely any scholar's library was without a copy. He was also made a prebendary of Westminster (November 9, 1631), treasurer to the chapter (1637), and subsequently sub-dean. He died in May, 1662.

HEYNE, CHRISTIAN GOTTLOB, one of the most distinguished critics and archæologists of the modern school of which Ernesti and Gesner were the founders, was born on September 25, 1729, in Chemnitz, Saxony. In 1748 he entered the university of Leipsic, with the professed intention of studying for the legal profession. He published his first edition of *Tibullus* in 1755, and in 1756 his *Epictetus*. On the death of Johann Matthias Gesner at Göttingen in 1761, the appointment to the vacant chair had been first offered to Ernesti, who, however, declined leaving the university of Leipsic, but proposed Ruhnken of Leyden or Saxe of Utrecht for the appointment. Ruhnken likewise refused it, but having been strongly impressed with the taste and learning displayed by the editor of *Tibullus* and *Epictetus*, he advised Münchhausen, the Hanoverian minister and principal curator of the university of Göttingen, to bestow the professorship on Heyne, who after some delay, became professor of eloquence in Göttingen. He refused the most advantageous and honorable overtures from Cassel, Berlin, and Dresden. As professor, prin-

cipal librarian, member of the Royal Society, and chief editor of the *Gelehrte Anzeigen*, and still more by his publications, he greatly contributed to raise the university of Göttingen to the distinguished rank it still holds among the seminaries of Europe. After a long and useful career, graced with all the distinctions which in Germany are conferred on literary eminence, he died, full of years and honor, on July 14, 1812.

HEYWOOD, a manufacturing town of Lancashire, is situated on the Roch, and on the Lancashire and Yorkshire Railway, three miles east of Bury and the same distance southwest of Rochdale. Population (1890), 25,000.

HEYWOOD, JOHN (*c.* 1500-1565), sometimes styled "the Epigrammist," was born, it is not known in what year, at North Mims near St. Albans. He was educated at Oxford, and afterward made the acquaintance of Sir Thomas More, who introduced him at court. His skill in music and his inexhaustible fund of ready wit made him a special favorite of Henry VIII., and afterward of his daughter Mary. On the accession of Elizabeth, Heywood, who was a zealous Catholic, retired to Malines in Belgium, where he died.

HEYWOOD, THOMAS, a voluminous dramatist and miscellaneous author of the sixteenth and seventeenth centuries, was born in Lincolnshire and was educated at Cambridge, where he became a fellow of Peterhouse. The dates of his birth and death are alike unknown, and the few facts of his life that are preserved have been gleaned chiefly from his own writings.

HEZEKIAH ("Jehovah makes strong;" *Ezechias*; the *Ha-za-ki-ya-hu* or *Ha-za-ki-a-hu* of the Assyrian inscriptions), one of the greatest and best of the kings of Judah, succeeded his father Ahaz when still a young man. The year of his accession was most probably 717 B.C.; and he ruled for twenty-nine years with a vigor and a success that deeply impressed later historians. The outset of his reign was marked by an emphatic reversal, both in foreign and in domestic affairs, of the policy which had been so disastrously followed by his weak and foolish predecessor. While Ahaz had shown distinctly paganizing tendencies in religion, Hezekiah was ardent in his zeal for the exclusive worship of Jehovah, which he sought to simplify, centralize, and refine even at the expense of abolishing many cherished institutions which had the sanction of ancient usage. As in the internal religious affairs of the theocratic kingdom so in its relations with foreign powers Hezekiah innovated very conspicuously on the policy of his father, although not here entirely on the lines laid down by the great contemporary prophet. Confirmed in the consciousness of military strength by a successful war against the Philistines, and having no longer anything to fear either from Damascus or from Samaria, he began to cherish the hope (at least with Egyptian support and the active coöperation of Egyptian cavalry) of being able to shake off entirely the yoke of Assyria, and with this view he set about extensive fortifications and other engineering works in and about Jerusalem. It was not, however, until after the accession of Sennacherib (705) and the resolution of that monarch to direct one of his great expeditions against Egypt (*c.* 701), that matters were brought to a sharp and immediate crisis between Nineveh and Jerusalem. The capture of all his fenced cities, Jerusalem excepted, coupled with the inactivity of Egypt, convinced Hezekiah of the uselessness of a struggle with the greatest military power of his century, in a way that Isaiah, with often repeated admonitions, had failed to do; and the payment of a large sum of money by way of tribute readily purchased a temporary relief. The sickness and recovery of Hezekiah seemed to have

preceded the invasion of Sennacherib by three years at most. Of the latter portion of Hezekiah's reign no details have been preserved; but it appears to have been characterized by peace and prosperity. He was succeeded in 688 by Manasseh, his son by Hephzibah, born apparently about 702.

HIBERNATION is the term employed by naturalists to denote the peculiar state of torpor in which many animals which inhabit cold or temperate climates pass the winter. In hot and dry countries, on the contrary, various animals pass into a similar condition during the hottest season of the year; and this state is called "Æstivation." Several of the animals which hibernate during the winter are liable to fall into a similar state at intervals during mild weather, and Dr. Marshall Hall has applied the term "Diurnation" to the day-sleep of bats, which he regards as precisely analogous to hibernation.

Although comparatively few mammals hibernate, the phenomena of hibernation and similar conditions have been better studied in this class than in any other. Dr. Marshall Hall has laid down the principle that the amount of respiration is inversely as the degree of irritability of the muscular fiber. Every gradation may be met with between ordinary sleep, the imperfect or abnormal hibernation of some animals, and the profound hibernation of others, in which all the functions of life are almost suspended. Such a condition is always accompanied by reduced respiration and increased irritability of the muscular fiber. If the respiration is reduced without this irritability being increased death results from torpor and asphyxia, whereas, if the respiration is increased simultaneously with increased irritability (as when an animal is aroused too suddenly), death likewise results from too great stimulation of the vital powers. The well-known danger of suddenly awakening a patient from a state of somnambulism is doubtless due to a similar cause.

Hibernation, however, is a physiological condition, and not produced simply by cold, though it is favored by it, because cold induces sleep, which may afterward pass into hibernation. It is an error to suppose that hibernating animals are capable of resisting any amount of cold, though their capacity of doing so must vary according to their species and to the climate which they inhabit. They always seek secure hiding-places where they may be protected from too great a degree of cold, as well as from interference. During hibernation the temperature of their bodies sinks to a point corresponding nearly to that of the surrounding atmosphere; but if they are exposed to an unusual amount of cold they are first awakened by it, and then sink into a fatal torpor like other animals. Many hibernating animals perish in this manner during severe winters. Respiration being almost suspended during hibernation, the maintenance of vitality depends almost wholly on the action of the heart, which will continue for a long time after an hibernating animal has been decapitated. Animals may also be placed in carbonic acid or under water for several hours without injury when in this condition, though they would die in a very few minutes if they were in their normal state.

Long-continued suspension of consciousness in man, whether voluntary or otherwise, is rare in temperate climates, but it is more frequent in India, where some religious ascetics are stated on unimpeachable authority to possess the power of throwing themselves into a state closely resembling hibernation for an indefinite period. Many curious cases have been recorded by Mr. Braid in his small treatise on *Human Hybernation*, published in 1850, the most celebrated of which is that of a fakir who was actually buried alive at Lahore, in 1837, in the

presence of Runjeet Singh and Sir Claude Wade, and who was dug up and restored to consciousness several months afterward, after every precaution had been taken to prevent any one from disturbing the grave in the interval. Among the mammals the bear, badger, hedgehog, porcupine, dormouse, and squirrel hibernate. Bats sleep almost all the winter.

Amphibia and Reptilia hibernate in cold or temperate climates. Land tortoises bury themselves in holes in the ground, and fresh-water tortoises in the banks or at the bottom of lakes and rivers. Lizards and snakes retire to holes in trees, under stones, or among dead leaves, where many species congregate in large numbers, and pass the winter closely entwined, and in a still more torpid condition than that of the hibernating mammals, their digestion and respiration being entirely suspended. Many tortoises, crocodiles and serpents bury themselves in mud in both South America and Africa, and æstivate in the hard-baked ground during the dry season of the year. When the viper is disturbed during the winter its bite is harmless; but this is not the case with the venomous serpents which æstivate in tropical countries.

HICCUP, or **HICCOUGH**, consists of sudden, short, convulsive inspirations, attended with a peculiar sound produced in the larynx, and immediately followed by expiration. The paroxysm may last only a few minutes, or may extend to hours or days; in the last-named case, it may be dangerous to life, from the exhaustion which it causes, but usually it merely excites a feeling of uneasiness or slight pain about the region of the diaphragm. When the attack is slight, it may often be stopped by making a very full inspiration, and then holding the breath as long as possible. Strong pressure, as a belt tightly drawn round the waist, will sometimes give relief. In more obstinate cases, aromatic spirit of ammonia, camphor, musk, etc., may be resorted to. A combination of camphor and chloroform, and the frequent swallowing of small-rounded pieces of ice, are perhaps the most efficient remedies.

HICKES, **GEORGE** (1642-1715), a learned English divine of the nonjuring party, and an eminent Anglo-Saxon scholar, was born at Newsham near Thirsk, Yorkshire. In 1659 he entered St. John's College, Oxford, whence after the Restoration he removed first to Magdalen College and subsequently to Magdalen Hall. In 1664 he was chosen fellow of Lincoln College, and in the following year proceeded M.A. On his return from a Continental tour in 1673 he graduated in divinity, and in 1675 he was appointed rector of St. Ebbe's, Oxford; in the following year he as private chaplain accompanied the duke of Lauderdale, the royal commissioner, to Scotland; and shortly afterward he received the degree of D.D. from the university of Glasgow. In 1680 he became vicar of All Hallows, Barking, London; and after having been made chaplain to the king in 1681, he was in 1683 promoted to the deanery of Worcester. At the revolution of 1688, having declined to take the oath of allegiance to William and Mary, he was first suspended and afterward deprived. He died in 1715.

HICKORY. The hickory trees are natives of North America, and belong to the genus *Carya* of botanists. They are closely allied to the walnuts (*Juglans*), the chief, or at least one very obvious difference being that, while in *Carya* the husk which covers the shell of the nut separates into four valves, in *Juglans* it consists of but one piece, which bursts irregularly. The hickory trees are of lofty growth, and are held in high estimation, both on account of their durable timber, and from the excellent nuts which some of the species produce. The timber is both strong and heavy, and remarkable

for its extreme elasticity, but it is not much used either for shipbuilding or for architectural purposes, as it decays rapidly when exposed to heat and moisture, and is peculiarly subject to the attacks of worms. It is very extensively employed in manufacturing musket stocks, axle-trees, screws, rake teeth, the bows of yokes, the wooden rings used on the rigging of vessels, chair backs, axe-handles, whip-handles, and other purposes requiring great strength and elasticity. Its principal use in America is for hoop-making; and when it is remembered how large a proportion of the productions of the United States is packed in barrels, some estimate may be formed of the consumption of hoops and of the consequent demand for hickory wood, which is the only American wood found perfectly fit for that purpose.

The wood of the hickory is of great value as fuel, on account of the brilliancy with which it burns and the ardent heat which it gives out, the charcoal being heavy, compact, and long-lived. The species which furnish the best wood are *Carya alba* (shellbark hickory), *C. tomentosa* (mockernut), *C. olivæformis* (pecan or pecane nut), and *C. porcina* (pig-nut), that of the last named, on account of its extreme tenacity, being preferred for axle-trees and axe-handles. The wood of *C. alba* splits very easily and is very elastic, so that it is much used for making whip-handles and baskets; the whip-handles are greatly esteemed for their suppleness, and considerable numbers of them are annually exported to England. The wood of this species is also used for making the back bows of Windsor chairs.

Most of the hickories form fine-looking, noble trees of from sixty to ninety feet in height, with straight, symmetrical trunks, well-balanced ample heads, and bold, handsome, pinnated foliage. When confined in the forest they shoot up fifty or sixty feet without branches, but when standing alone they expand into a fine head, and produce a lofty round-headed pyramid of foliage. They have all the qualities which are necessary to constitute fine graceful park trees, and are justly entitled to a place in every considerable plantation. The most ornamental of the species are *C. olivæformis*, *C. alba* and *C. porcina*, the last two also producing delicious nuts, and being worthy of cultivation for their fruit alone.

The husk of the hickory nut, as already stated, breaks up into four equal valves or separates into four equal portions in the upper part, while the nut itself is tolerably even on the surface, but has four or more blunt angles in its transverse outline. The hickory nuts of the American markets are the produce of *C. alba*, which is called the shell-bark hickory, because of the roughness of its bark, which becomes loosened from the trunk in long scales bending outward at the extremities and adhering only by the middle. The nuts are much esteemed in all parts of the Union, and are exported in considerable quantities to Europe. The pecan-nuts, which come from the Western States, are from an inch to an inch and a half long, smooth, cylindrical, pointed at the ends, and thin-shelled, with the kernels full, not like those of most of the hickories divided by partitions, and of delicate and agreeable flavor. The thick-shelled fruits of the pig-nut are generally left on the ground for swine, squirrels, etc., to devour. In *C. amara* the kernel is so bitter that even the squirrels refuse to eat it.

HICKS, ELIAS, founder of the Hicksites, one of the two great sections into which the Society of Friends in America has, since 1828, been divided (see QUAKERS), was born at Hempstead, Long Island, on March 19, 1748. During the earlier part of his life he followed the business of a carpenter and housebuilder; but this occupation he latterly exchanged for that of farming. Reared in a Quaker family, he began, when about

twenty-seven years of age, to "have openings leading to the ministry," and to be "deeply engaged for the right administration of discipline and order in the church." In the intervals of business, accordingly, he began to visit the meetings and families of Friends throughout an extensive range of country; and soon established a very considerable reputation as an efficient and popular itinerant preacher. His first literary effort seems to have been made no earlier than 1811, when he published *Observations on Slavery*; those doctrinal divergences from the received orthodox creed of the Friends, by which his name was brought into the prominence it now possesses, appear not to have become visible until 1820, when he wrote a *Doctrinal Epistle* (published in 1824), which was followed by much controversy, and resulted in 1828 in the formal separation from the Hicksites of their more orthodox Quaker brethren. The points involved were justly considered to affect the fundamental doctrines of the Christian religion, such as those of the Trinity, the Incarnation, and the supreme authority of Scripture. Hicks died at Jericho, Long Island, on February 27, 1830.

HIERAPOLIS. Of the many cities in the Greek world bearing this name the following are the most important.

1. A city of Syria Cyrrhestica, situated on some hills about sixteen miles southwest from the junction of the Euphrates and the Sajur. Besides the natural strength of its position, it was important as lying on the line of intercourse between Northern Syria and Mesopotamia, and was always a great trading city. Its early history is quite unknown.

2. A city in Phrygia, at the junction of the Lycus and Meander, on the road from Apamea to Sardis. In it there were warm springs which had and still have a remarkable power of forming incrustations. Its name, Hierapolis, is due to the sancity conferred on it by these hot springs, and by the Plutonium, a small cave under a projecting rock, from which there constantly emanated a dark vapor, deadly to man and beast.

HIERARCHY. From *ἱεράρχης*, meaning a steward or guardian of holy things, is derived *ἱεραρχία*, naturally signifying the office of such a steward or guardian, but most commonly used in ecclesiastical language to denote the aggregate of those persons who exercise authority within the Christian Church—the patriarchate, episcopate, or entire threefold order of the clergy. The word, which does not occur in any classical Greek writer, owes its present extensive currency to the celebrated writings of Dionysius Pseudo-Areopagita, which, originating probably in the age of Justinian, exerted, during the ninth and following centuries, so remarkable an influence on the current of theological speculation, both in the Eastern and in the Western Church. Of these the most important are the two which treat of the celestial and of the ecclesiastical hierarchy, respectively. Defining hierarchy as the "function which comprises all sacred things," or, more fully, as "a sacred order and science and activity, assimilated as far as possible to the godlike, and elevated to the imitation of God proportionately to the Divine illuminations conceded to it," the author proceeds to enumerate the nine orders of the heavenly host, which are subdivided again into hierarchies or triads, in descending order, thus: Seraphim, Cherubim, Thrones; Dominations, Virtues, Powers; Principalities, Archangels, Angels. These all exist for the common object of raising men through ascending stages of purification and illumination to perfection. The ecclesiastical or earthly hierarchy is the counterpart of the other. In it the first or highest triad is formed by baptism, communion and chrism. The second triad consists of the three orders of the ministry, bishop or hierarch, priest

and minister or deacon; this is the earliest known instance in which the title hierarch is applied to a bishop. The third or lowest triad is made up of monks, "initiated," and catechumens.

Some kind of hierarchy, both of orders and of jurisdiction, may, from the nature of the case, be looked for in every religious system that has attained any considerable degree of visibility and external organization. The ancient Jewish and Egyptian hierarchies, for example, find parallels in Parsism and Mahometanism; while in some regions Buddhism has attained a degree of complexity in its ecclesiastical government strikingly suggestive of many features of the present Roman hierarchy.

HIERAX, or **HIERACAS**, a learned ascetic who flourished about the end of the third century at Leontopolis in Egypt, where he lived to the age of ninety, supporting himself by caligraphy and devoting his leisure to scientific and literary pursuits, especially to the study of the Bible. He was the author of Biblical commentaries both in Greek and Coptic, and is said to have composed many hymns.

HIERO, the name of two rulers of Syracuse.

HIERO I., displacing his infant nephew, succeeded his famous brother Gelon as tyrant of Syracuse in 478 B.C. His rule was more tyrannical than Gelon's had been. He removed the inhabitants of Naxos and Catana to Leontini, and peopled Catana, which he renamed Ætna, with Dorians. He was also an important factor in the history of Agrigentum, of Rhegium, and of Locri; and he saved the Greeks of Campania from the Etruscans, whose naval power he destroyed by his great victory at Cumæ, (474 B.C.) Though despotic in his rule, he was a hearty patron of literature, and numbered among his friends such names as Æschylus, Bacchylides, Epicharmus, Simonides, and Pindar — the last of whom celebrated his victories in the Grecian games. He died at Catana in 467 B.C.

HIERO II., king of Syracuse, was an illegitimate son of a Syracusan noble, Hierocles, who claimed descent from Gelon (see **GELON**). His birth must have taken place before the year 306 B.C. On the departure of Pyrrhus from Sicily (in 275 or end of 276 B.C.), the Syracusan army and citizens alike marked their approval of Hiero's military and popular qualities by placing him at the head of the troops. He raised a native force, with which he drove the Mamertines into the corner of the island, defeated them in a pitched battle, and was prevented from capturing Messana only by Carthaginian interference. His grateful countrymen then chose him king (270 B.C.) In 264 he again returned to the attack, and the Mamertines called in the aid of Rome. Hiero joined the Punic leader Hanno, who had newly landed in Sicily; but, being defeated by the consul, Appius Claudius, he withdrew to Syracuse. Pressed by the Roman forces, he was in 263 compelled to conclude a treaty with Rome, by which he was to rule over the southeast of Sicily and the eastern coast to Tauromenium. From this time till his death in 216 he remained the fast friend of Rome, rendering frequent and valuable service during the First Punic War by supplying men, material, and provisions. When the Second Punic War broke out, he joined his fleet to that of Sempronius, and offered supplies of food and clothing. At home he was a wise and just ruler. He restrained the republican senate, and governed as a constitutional monarch. He kept up a powerful fleet for defensive purposes, and employed his famous kinsman, Archimedes, in the construction of those engines that, at a later date, played so important a part during the siege of Syracuse by the Romans. His only son, Gelon, predeceased him, and he was succeeded by his grandson, Hieronymus.

HIEROCLES, a Roman proconsul, first of Bithynia and afterward of Alexandria, flourished during the reign of Diocletian (284–305 A. D.), and is said to have been the instigator of the fierce persecution of the Christians under Galerius Cæsar in 303.

HIEROCLES, a Neo-Platonic writer of the fifth century A.D., was apparently a native of Alexandria. He was born most probably about the beginning of the fifth century, studied under the celebrated Neo-Platonist Plutarch at Athens, and taught for some years in his native town. He seems to have been banished from Alexandria and to have taken up his abode in Constantinople, where he endured some persecution for his religious opinions. His death must be referred to the closing decade of the fifth century, probably about 490. The only complete work of his which has come down to us is the commentary on the great Pythagorean *Carmen Aureum*, but several other writings, specially one on Providence or Foreknowledge, are quoted or referred to by Photius and Stobæus.

HIEROGLYPHICS. The term hieroglyphics is used, with others, by Greek and Latin writers to describe the sacred characters of the ancient Egyptian language in its classical phase. It is used by the moderns for various systems of writing in which figures of objects take the place of conventional signs. The written language of the ancient Egyptians remained the same from the date of the earliest monuments (Third Dynasty) until the age of the Ethiopian kings (B.C. *cir.* 700), when a vulgar dialect expressing the common speech is first found in written documents. Then, if not earlier, the older phase of the language became the classical Egyptian, sometimes called the sacred dialect, to distinguish it from the vulgar dialect. The classical Egyptian was used almost as late as the fall of paganism generally, for all documents but legal and commercial ones, for which the vulgar dialect was used.

It is necessary to observe that, although Egyptian is not proved to be a Semitic language, it contains in its oldest known form undoubted Semitic elements, both in structure and roots. It must also be borne in mind that the grammar of ancient Egyptian is in its infancy. We know many of its principal facts, but we do not know them accurately. For instance, we know the forms of many tenses of the verb, and can perhaps place these tenses in groups, as past, present and future, but we cannot define the different senses of the various tenses of each group. Similarly, in Coptic we do not always know the shades of difference within a group of tenses. It may be that in Coptic these shades have disappeared through the decay of the language, but it would be rash to affirm this of the classical Egyptian.

The elements of Egyptian writing are composed of a certain number of actual objects, natural or artificial, imitated by drawing or engraving.

Egyptian writing falls into three systems — (1) hieroglyphic, (2) hieratic, (3) demotic or enchorial, the hieratic being a simplified form of hieroglyphic, and the demotic of hieratic. The complete designing of hieroglyphics required skill and time. They thus came to be reduced in writing to the simplest forms which retained the leading characteristics. These were called by Champollion linear hieroglyphics. The linear forms not lending themselves with sufficient readiness to very rapid writing, a further abbreviation was made, by which the forms became almost conventional — the original type usually ceasing to be immediately recognizable; this cursive system Champollion called hieratic. The demotic writing is a new abbreviation of the hieratic; it gradually departs so far from the original types as to appear to consist of arbitrary signs.

Hieroglyphics are written either in horizontal lines or

vertical columns, and are ordinarily read from the right. The heads of animals and the like show from what direction to begin reading. Hieratic and demotic are written from right to left, in horizontal lines. In very early times hieratic is sometimes written in vertical columns.

The hieroglyphic is a lapidary system, the hieratic and demotic purely systems for common writing. Consequently the hieroglyphic is the most difficult of the three to read, as the engraver or painter paid great attention to the symmetrical appearance of each group of signs, and grammatical forms were hence often omitted. In hieratic and demotic the signs follow each other without interruption of the natural order, and the grammatical forms are usually given, and even more fully.

Intentionally accumulated exceptions in certain texts compose what Champollion has called the Secret Writing. The most ancient traces we have found are of the Eighteenth Dynasty. In this system we remark — (1) objects rare or unused in ordinary writing; (2) syllabic signs used as simple letters; (3) phonetic values obtained by turning the signs from their ordinary ideographic values; (4) variants between the values of neighboring sounds. Thus every deviation was made from the usual principles of writing by which it was possible to produce exceptions. This is an enigmatic system intended to be unintelligible to the ordinary reader. The causes of this method are of interest, for from them originated the new values which strangely complicate the hieroglyphic writing of the time of the Greeks and Romans (the secret writing thus passing in a certain degree into the common writing).

HIERONYMITES, HIERONYMIANI, or SANCTI HIERONYMI EREMITÆ, an order of monks, originally hermits, who resolved to adopt the cenobite life under the patronage of St. Jerome and the rule of St. Augustine. The order first arose in the fourteenth century in the neighborhood of Toledo. It received papal sanction (from Gregory XI. in 1373), and made considerable progress in Spain and Portugal. From about the close of the sixteenth century it rapidly decayed, and now it is wholly extinct.

HIGDON, or HIGDEN, RANULF, was a Benedictine monk of the monastery of St. Werberg in Chester, in which he lived, it is said, for sixty-four years, and died "in a good old age," probably in the year 1363. Higdon was the author of a long chronicle, one of several such works based on a plan taken from Scripture, and written for the amusement and instruction of the society to which the compiler belonged. Its chief interest perhaps lies in the fact that it closes the long series of general chronicles, which were soon put completely out of date by the invention of printing.

HIGHGATE, a suburb of London, county of Middlesex, is situated on an eminence on the great north road, five and one-half miles northwest of London. From various points on the hill, which reaches a height of 426 feet, striking views are obtained of London and its suburbs. The North London cemetery in the neighborhood contains the graves and monuments of a great number of celebrities. Highgate is supposed by some to have received its name from the gate erected by the bishop of London for the purpose of receiving toll from the passengers by the road which at this point entered his park; but it is possible that gate is here used according to its old signification, and that the name simply means high road. The road was constructed in the fourteenth century, and the toll-house was built on the site of an ancient hermitage. In the time of stage-coaches a custom was introduced of making ignorant persons believe that they required to be sworn and ad-

mitted to the freedom of the Highgate before being allowed to pass the gate, the fine of admission being a bottle of wine, which was discussed at the conclusion of the ceremony. The population of the parish is about 12,000.

HIGH PLACE is the rendering invariably given in the authorized English version of the Old Testament Scriptures to a Hebrew word **בֶּמָה** of uncertain deriva-

tion but with much plausibility connected by Gesenius with the Indo-Germanic root which appears in the Persian *bam* (roof, summit). The habit so widely diffused among primitive people of selecting the tops of mountains, or at least elevated sites, as suitable from their comparative isolation from the world and their supposed nearness to the sky for the erection of altars and sacred pillars, is so obviously natural as to require no explanation. Along with that of worshiping under trees or groves (see **GROVE**), it was fully participated in by the Israelites from an early period, and continued to assert itself down to a very late date, as is abundantly shown by the frequency with which *bamah* and other words signifying height occur in connection with their public and private worship, whether Jehovistic or idolatrous.

HIGHWAYS. A highway is a public road over which all persons have full right of way — walking, riding, or driving. See **ROADS**.

Highway, in the law of the States of the American Union, generally means a lawful public road, over which all citizens are allowed to pass and repass on foot, on horseback, in carriages and wagons. Sometimes it is held to be restricted to county roads as opposed to town-ways. In statutes dealing with offenses connected with the highway, such as gaming, negligence of carriers, etc., "highway" includes navigable rivers. But in a statute punishing with death robbery on the highway, railways were held not to be included in the term. In one case it has been held that any way is a highway which has been used as such for fifty years.

HILARION, ST., abbot, the first to introduce the monastic system into Palestine, was born of heathen parents at Tabatha, about five miles to the south of Gaza, about the year 288; was sent when very young to Alexandria to be educated, and there became a convert to the Christian religion. Attracted by the fame of St. Anthony, he went to visit that saint in his solitude, and forthwith became a disciple, and withdrew into loneliness in the desert between the sea and the marshes on the Egyptian border. In this solitude he observed the most rigid asceticism, and (to quote the quaint remark of Butler) "thought himself at liberty to practice certain mortifications, which the respect we owe to our neighbor makes unseasonable to the world." He died in 371.

HILARIUS, or HILARUS (HILARY), bishop of Rome from 461 to 467, who, according to some authorities, had attained to the archidiaconate as early as the year 417, is known to have been a deacon, and to have acted as legate to Leo the Great at the "robber" synod of Ephesus in 449. Chosen to succeed Leo on November 12, 461, he issued a brief *de fide catholica*, in which he anathematized Eutyches, Nestorius and Dioscurus, and reaffirmed the decisions of the councils of Nice, Ephesus and Chalcedon. In 465 he held at Rome a council, which put a stop to some prevalent abuses, particularly to that of bishops appointing their own successors. His pontificate was also marked by a successful encroachment of the papal authority on the metropolitan rights of the French and Spanish hierarchy, and by a resistance to the toleration edict of Anthemius, which ultimately caused it to be recalled. Hilarius, who died November 17, 467, was succeeded by Simplicius.

HILARIUS, St. of Arles, an eminent prelate and an able if unsuccessful defender of the liberties of the Gallican Church, was born about 403, and in early youth entered the abbey of Lerins, then presided over by his kinsman Honoratus (St. Honoré). Having succeeded Honoratus in the bishopric of Arles in 429, he set about the discharge of his episcopal functions with unusual energy and zeal. As bishop of Arles he held the rank of metropolitan of Vienne and Narbonne, and in this capacity he came in collision in 444 with Leo the Great on the question of the deposition of one of his bishops (Chelidonius); this quarrel resulted in his being deprived of his rights as metropolitan to consecrate bishops, call synods, or exercise ecclesiastical oversight in the province, and in the edict of Valentinian III., so important in the history of the Gallican Church. He died in 449, and his name was afterward introduced into the Roman martyrology for commemoration on May 5th.

HILARIUS, St., bishop of Pictavium (Poitiers), an eminent "doctor" of the Western Church, was born at Poitiers about the end of the third century A.D. His parents, who were pagans of distinction, afforded him every means of acquiring a good education; and to the ordinary accomplishments of an educated gentleman there was added in his case what had even then become somewhat rare in the West, some knowledge of Greek. After he had attained to manhood his attention was directed to the Old and New Testament writings, with the result that he became convinced of the truth of Christianity, and along with his wife and his daughter received the sacrament of baptism. About 353, although still a married man, he was by the unanimous voice elected bishop. At that time Arianism, which under imperial protection had overspread the Eastern, was now under similar auspices threatening also to overrun the Western Church; to resist and repel the irruption was the great task which Hilary now set himself to achieve. One of his first steps was to secure the excommunication by those of the Gallican hierarchy who still remained orthodox, of Saturninus, the Arian bishop of Arles, along with Ursacius and Valens, two of the most prominent of the supporters of that prelate. About the same time he wrote to the emperor Constantius a remonstrance against the persecutions by which the Arians had sought to crush their opponents. In 359 Hilary attended the convocation of bishops at Seleucia in Isauria, where, along with the Egyptian Athanasians, he joined the Homoiousian majority against the Arianizing party headed by Acacius of Cæsarea; thence he betook himself to Constantinople, and in a petition (*Ad Constantium Augustum Liber Secundus*) personally presented to the emperor in 360, repudiated the personal calumnies of his enemies and sought to vindicate his Trinitarian principles. The latter years of Hilary's life were spent in comparative quiet and retirement, devoted in part to the preparation of his expositions of the Psalms, for which he was largely indebted to Origen; of his *Commentarius in Evangelium Matthæi*, a work of no exegetical value; and of his no longer extant treatise on the book of Job. He died January 13, 368.

HILDA, or **HILD** (614-680), usually called St. Hilda, a Saxon lady whose name is intimately associated with the history of the early English church and of early English literature. She was a member of the royal family of Northumbria, her father Hereric being a nephew of King Edwin: and, along with her royal kinsman, she received baptism at the hands of Paulinus. In 649, two years after her consecration as a nun, she was appointed to succeed Heru, the abbess of Heortea or Hartlepool. In 658 the abbess founded the famous monastery on the cliffs at Streoneshall or Whitby, and for the next twenty-two years she ruled with rare

ability and virtue over the double community of monks and nuns which gathered round her. Among those who shed the most abiding luster on the establishment were St. John of Beverley and the Saxon poet Cædmon. Hilda died in 680.

HILDBURGHAUSEN, the chief town of a circle in the duchy of Saxe-Meiningen, Germany, is situated in a wide and fruitful valley on the river Werra and on the Werra railway, nineteen miles southeast of Meiningen. Population 6,000.

HILDEBERT (HYDALBERT, GILDEBERT, ALDEBERT) of Le Mans and afterward of Tours, a prominent church-leader, and one of the best Latin writers of his century, was born about 1055 at Lavardin near Vendôme, became a pupil of the famous Berengarius of Tours, archdeacon, and finally, in 1097, bishop of Le Mans. A dispute with Louis the Fat about the rights of ecclesiastical patronage brought him in to much disfavor with that monarch; but their mutual relations had much improved before the death of Hildebert, which took place on December 18, 1134. From some writers he has received the name of Saint, but his name occurs in no martyrology.

HILDEBRAND. See GREGORY VII.

HILDEBRANDSLIED. This invaluable example of Old German alliterative poetry is contained in a MS. originally belonging to the library of Fulda, and now preserved at Cassel. It is written on the first and last pages of a volume of Biblical and theological contents by two contemporary hands apparently belonging to the beginning of the ninth century. The conclusion of the poem is unfortunately wanting, evidently from want of space.

HILDEBRANDT, **EDUARD**, was born in 1817, at Dantzig. He was not twenty when he went to Berlin, where he was taken in hand by Wilhelm Krause, a painter of sea-pieces. Like other artists who have earned a name for subtle and rapid execution, he worked at first in a formal, smooth, and timid fashion. Several early pieces exhibited after his death,—a breakwater, dated 1838, ships in a breeze off Swinemünde (1840), and other canvases of this and the following year,—show Hildebrandt to have been a careful student of nature, with inborn talents kept down by the conventionalisms of the formal school to which Krause belonged. Hildebrandt died at Berlin on October 25, 1868.

HILDEBRANDT, **THEODORE** (born at Stettin, 1804, died at Düsseldorf 1874), was a disciple of the painter Schadow, and, on Schadow's appointment to the presidency of a new academy in the Rhenish provinces in 1828, followed that master to Düsseldorf. Bred in the academy of Berlin, and finished under Schadow (1820-24), Hildebrandt began by painting pictures illustrative of Goethe and Shakespeare; but in this form he followed the traditions of the stage rather than the laws of nature. The picture which made Hildebrandt's fame is the *Murder of the Children of King Edward*, of which the original, afterward frequently copied, still belongs to the Spiegel collection at Halberstadt. Comparatively late in life Hildebrandt tried his powers as an historical painter in pictures representing Wolsey and Henry VIII., but he lapsed again into the romantic in Othello and Desdemona, a fair replica of which, in Schulte's collection at Düsseldorf, gives a good idea of his shiny, ineffective, technical execution. After 1847 Hildebrandt gave himself up to portrait painting, and in that branch succeeded in obtaining a large practice.

HILDEGARD, commonly referred to as St. Hildegard, abbess, "prophetess," and a figure of some consequence in the history of mediæval mysticism, was born at Böckheleim, diocese of Mainz, in 1098 (or 1099.)

From earliest childhood, we learn from Hildegard herself, she was accustomed to see visions which increased in frequency and vividness as she approached the age of womanhood; these, however, she for many years, though with great pain, kept almost wholly secret, nor was it until she had reached her forty-third year (1141) that she felt constrained at last to divulge them. Committed to writing by her intimate friend the monk Godefridus, they now form the first and most important of her printed works, entitled *Scivias*. Among her correspondents were Popes Anastasius IV. and Hadrian IV., the emperors Conrad III. and Frederick I., and also the theologian Guibert of Gembloux, who submitted numerous questions in dogmatics for her determination.

HILDEN, a town of Prussia, in the government and circle of Düsseldorf, on the Itterbach. It is a station on the Rhenish railway, and has a considerable manufacture of silks, both pure and mixed, calico, and machinery; it also possesses a deaconess institute. Population, 7,500.

HILDESHEIM, the chief town of a district in the province of Hanover, Prussia, is beautifully situated on the right bank of the Innerste, eighteen miles south-east of Hanover by railway. It has a very antique and quaint appearance, and is surrounded by old ramparts which have been converted into shady alleys and promenades. The streets are for the most part narrow and irregular and contain many old houses with overhanging upper stories and richly and curiously adorned wooden façades. The town is the seat of a district governorship, a high court of justice, two justice courts, a general superintendency of the Evangelical Church, and a Roman Catholic chapter. The Catholic cathedral, which occupies the site of a building founded by Louis the Pious in 818, dates from the middle of the eleventh century. It is chiefly remarkable for the antiquities and notable works of art connected with it. The town has iron foundries, manufactures of cloth, damasks, linen fabrics, thread, sail-cloth, wadding, leather, machines, carriages, stoves, glass, tobacco, alcohol, perfumeries, chocolate, and starch. The population is 23,000.

HILDRETH, RICHARD, an American journalist and author, was born at Deerfield, Mass., June 28, 1807. He was educated at Harvard College, where he graduated in 1826; and after studying law at Newburyport, he was called to the Boston bar in 1830. In 1832 he became joint founder and editor of a daily newspaper, the *Boston Atlas*. Having in 1834 gone to the south for the benefit of his health, he was led by what he witnessed of the evils of slavery to write the anti-slavery novel *Archy Moore*, which, chiefly on account of its subject, met with considerable success in America and England. An enlarged edition appeared of it in 1852 under the title of the *White Slave*. In 1837 he wrote *Banks, Banking and Paper Currency*, a work which had some influence in fostering the growth of the free banking system in America. In 1838 he resumed his editorial duties on the *Atlas*, but in 1840 he found it necessary, on account of his health, to remove to British Guiana, where he was editor of two weekly newspapers in succession at Georgetown. He published in the same year *Despotism in America*, and he also made the columns of his newspapers the medium for the dissemination of anti-slavery opinions. In 1849 he published the first three volumes of a *History of the United States*, a work which, if its narrative is rather bald and tame, is characterized by perfect fairness and candor, and displays great industry and care in the representation of facts. Other three volumes, completing the work, appeared in 1855. His *Japan as it was and is* is a valu-

able digest of the information contained in other works on that country. He also wrote *Theory of Morals* (1844), and *Theory of Politics* (1853), as well as *Lives of Atrocious Judges*, compiled from Lord Campbell's two works. For some time Hildreth was on the editorial staff of the *New York Tribune*, and he was also a frequent contributor to periodicals. In 1861 he was appointed United States consul at Trieste, but ill health compelled him to resign his office and remove to Florence, where he died July 21, 1865.

HILL, AARON (1685-1749 or 1750), an English poet and miscellaneous writer, was born in London, February 10, 1685, and died about 1750.

HILL, MATTHEW DAVENPORT, was born August 6, 1792, at Birmingham. He was called to the bar in 1819. In 1832 he was elected one of the Liberal members for Kingston-upon-Hull, but he lost his seat at the next election in 1834. On the incorporation of Birmingham in 1839 he was chosen recorder; and in 1851 he was appointed commissioner in bankruptcy for the Bristol district. Hill was one of the chief promoters of the Society for the Diffusion of Useful Knowledge, and the originator of the *Penny Magazine*. He died June 7, 1872.

HILL, ROWLAND, an eccentric and popular English preacher, was born at Hawkstone, England, August, 23, 1744. After receiving his early education at the grammar school of Shrewsbury and at Eton, he in 1764 entered St. John's College, Cambridge. While at the university he made the acquaintance of the Methodist preacher Whitfield, and stimulated by his example he somewhat scandalized the university authorities and his own friends by preaching, before he had obtained holy orders, in the surrounding villages, and conducting religious services in the houses of the sick and poor. After graduating with distinction he took orders, and in 1773 was appointed to the parish of Kingston, Somersetshire, where he began to indulge his favorite taste for open air preaching, and soon attracted great crowds to the services which he held nearly every day of the week. Having on the death of his father in 1780 inherited considerable property, he built for his own use Surrey Chapel, in the Blackfriars Road, London. The chapel was opened on June 8, 1783. Though now practically occupying the ecclesiastical position of a dissenter, Hill conducted his services in accordance with the forms of the Church of England, in whose communion he always remained. From the beginning his success was complete, and his chapel soon came to be filled with an audience such as no other preacher in London could boast. During the summer months he made what he called "gospel-tours" in all parts of the country, sometimes extending them to Scotland and Ireland, and attracted wherever he went audiences as numerous and as interested as those which had crowded to hear Whitfield. After these tours he always returned with increased enthusiasm to his duties at Surrey Chapel, where he continued to officiate almost to the day of his death, April 11, 1833. The oratory of Rowland Hill, like that of Whitfield, was specially adapted for rude and uncultivated audiences, and it was equally effective.

HILL, SIR ROWLAND, originator of the penny postal system, a younger brother of Matthew Davenport Hill, was born December 3, 1795, at Kidderminster. After his marriage in 1827 Hill taught school at Bruce Castle, Tottenham, which he conducted until failing health compelled him to retire in 1833. About this time he became secretary of Gibbon Wakefield's scheme for colonizing South Australia, the objects of which he explained in 1832 in a pamphlet on *Home Colonies*, afterward partly reprinted during the Irish famine under the title *Home Colonies for Ireland*. It was in 1835

that his zeal as an administrative reformer was first directed to the postal system. After a laborious collection of statistics he succeeded in satisfying himself and in demonstrating to the world that the principal expense of a letter carriage was in receiving and distributing, and that the cost of conveyance differed so little with the distance that a uniform rate of postage was in reality the fairest to all parties that could be adopted. Trusting also that the deficiency in the postal rate would be made up by the immense increase of correspondence, and by the saving which would be obtained from prepayment, from improved methods of keeping accounts, and from lessening the expense of distribution, he in his famous pamphlet published in 1857 recommended that within the United Kingdom the rate for letters not exceeding half an ounce in weight should be only one penny. So great became the pressure of public opinion against the opposition offered to the measure by official prepossessions and prejudices that in 1838 the House of Commons appointed a committee to examine the subject. The committee having reported favorably, a bill to carry out Hill's recommendations was brought in by the Government. The Act received the royal assent in 1839, and after an intermediate rate of fourpence had been in operation from December 5th of that year, the penny rate commenced January 10, 1840. Hill received an appointment in the Treasury in order to superintend the introduction of his reforms, but he was compelled to retire when the Liberal Government resigned office in 1841. In consideration of the loss he thus sustained, and to mark the public appreciation of his services, he was in 1846 presented with the sum of £13,360. On the Liberals returning to office in the same year he was appointed secretary to the postmaster-general, and in 1854 he was made chief secretary. In 1860 his services were rewarded with the honor of knighthood; and when failing health compelled him to resign his office in 1864, he received from parliament a grant of £20,000, and was also allowed to retain his full salary of £2,000 a year as retiring pension. In 1864 the university of Oxford conferred on him the degree of D.C.L., and on June 6, 1879, he was presented with the freedom of the city of London. He died August 27th following, and was buried at Westminster Abbey.

HILL, VISCOUNT. Rowland Hill, nephew of the Rev. Rowland Hill, was born at Prees, Shropshire, August 11, 1772. After receiving his early education at Ighfield and Chester, he was gazetted to the 38th regiment. In the beginning of 1793 he raised an independent company, and was promoted to the rank of captain. The same year he distinguished himself in the siege of Toulon; and after serving some time on the continent he in 1797 set out as colonel of the 90th regiment with Sir Ralph Abercromby's expedition to Egypt, where he acquired great distinction, and was wounded at the battle of Alexandria. Having in 1803 been gazetted brigadier-general, he in 1808 accompanied Sir Arthur Wellesley to Spain, and from Vimiera to Vittoria, in advance or retreat, he proved himself the most indefatigable coadjutor of the great captain. In 1809 he was gazetted lieutenant-general, and in the following year was appointed to the independent command of the second army corps of Wellington in Portugal; in 1811 he annihilated the French army under Girard at Arroyomolinos (Caceres), in recognition of which he received the order of the Bath; and for his capture of the forts of Almaraz, which cut off the communication between the French armies on the north and south sides of the Tagus, he was in 1814 rewarded with the title of Baron Hill of Almaraz. In 1813 he held temporarily the command of the English and Hanoverian troops in Belgium, and two years later crowned the glories of his noble

career by his conduct at Waterloo, where he was at the head of the brigade which resisted and repulsed the last effort made in behalf of the French by the imperial guard. When Wellington became premier in 1828, Hill received the appointment of general commanding-in-chief, and on resigning this office in 1842, he was created a viscount. He died on December 10th of the same year.

HILLAH, a town of Asiatic Turkey in the pashalik of Baghdad. It is picturesquely situated, in the midst of a very fertile district, on both banks of the Euphrates, which are connected there by a floating bridge 450 feet in length. Population, 10,000.

HILLARD, GEORGE STILLMAN, an American author, was born at Machias, State of Maine, September 22, 1808. After graduating at Harvard College in 1828, he became joint rector of the Round Hill Seminary at Northampton. In 1833 he was called to the Boston bar. He was chosen a member of the common council of Boston in 1845, and he was for six months its president. In 1849 he was elected a member of the state legislature. The engrossing character of his professional and other engagements did not, however, prevent him from devoting a large portion of his time to literature. Besides editing successively the *Christian Register* (a Unitarian paper), *The Jurist*, and the *Boston Courier*, he published an edition of Spenser's works (in 5 vols., 1839), and a selection from the works of Walter Savage Landor (1836), and wrote *Six Months in Italy* (2 vols., 1833), *Life and Campaigns of George B. McClellan* (1865), a series of school-books which have met with wide acceptance, and various articles in periodicals and encyclopædias. From 1867 to 1878 he was United States district attorney for Massachusetts. He died January 27, 1879.

HILLEL, a famous Jewish rabbi, sometimes called for distinction's sake "the elder" or "the old," flourished about the time of Herod the Great. According to the Talmudists, he was born of a poor Davidic family, at Babylon, apparently about the year 75 B. C.

HILLER, JOHANN ADAM (1728-1804), musical composer, was born at Wendisch-Ossig, near Görlitz in Silesia, December 25, 1728, and died June 16, 1804.

HILL TIPPERAH, a native state adjoining the British district of Tipperah, Bengal, with an area of about 3,867 square miles, and population 75,792. It is bounded on the north by the Assam district of Sylhet, on the west by the Bengal districts of Tipperah and Noákáhlí, on the south by Noákáhlí and Chittagong districts, and on the east by the Lushai country and the Chittagong Hill Tracts. As its name implies the country is hilly. Five or six ranges of hills run parallel from north to south, at an average distance of about twelve miles from each other. The hills are covered for the most part with bamboo jungle, while the low ground abounds with trees of various kinds, canebrakes, and swamps. The principal ranges are, beginning from the east, the Jámpui, Sakkankhang, Langtarái, and Atháramurá. The chief rivers are the Gumti, Háorá, Khozái, Dulái, Manu, and Pheni. During the heavy rains, the people in the plains use boats, as almost the sole means of conveyance. The forests give shelter to numbers of wild elephants and other large game. Small game of various kinds are met with.

HILTON, WILLIAM, English painter, was born in Lincoln, June 3, 1786, son of a portrait painter. In 1814, having exhibited *Miranda* and *Ferdinand* with the *Logs of Wood*, he was elected an associate of the Academy, and in 1820 a full academician, his diploma-picture representing *Ganymede*. He died in 1839.

HILVERSUM, a village and commune in the

Netherlands in the province of North Holland, about equally distant from Amsterdam, Utrecht and Amersfoort, with all of which it is connected by railway. Population about 7,000.

HIMALAYA is the name given to the mountains which form the northern boundary of British India, between the 75th and 95th meridians east of Greenwich. The word is Sanskrit, and literally signifies "snow-abode."

Although the term Himalaya is applied by the natives of India only to the ranges which they see covered with perpetual snow, it has been long used by European geographers to designate the whole mountain region for which the Indian has no other name than *pāhār*, *i.e.*, "the mountains," of which the snowy ranges constitute but a small portion. The first mere cursory examination of these mountains by the older geographers rightly convinced them of the general physical unity of the mountainous region to the north of India, which in length extends from about 72° to 95° E. long., that is, between the rivers Indus and Brahmaputra, and in breadth includes the ranges between the plains of Hindustan and the upper parts of the main branches of these two great rivers. To these ranges the designation of Himalaya has by degrees been specially attached; and there is a certain convenience in still restricting the name to that part of the mountains which is accessible from British India, for this is the practical signification of it now commonly accepted.

Scientific investigation has clearly shown that, so far as the main characteristics of the mountains are concerned, the natural boundaries of the Himalayan system must be carried much further than had at first been recognized. Considerable obscurity still involves the eastern portion of these mountains, and there is great want of precise knowledge as to their connection with the ranges of western China, from which are thrown off the great rivers of China, Siam, and Burmah. On the west however, it has been completely established that a continuous chain extends beyond the Indus along the north of the Oxus, and ends in that quarter about 68° E. longitude. In like manner it is found that no separation can be established, except a purely arbitrary one, between the Himalaya as commonly defined and the greatly elevated and rugged table-land of Tibet; nor between this last and the mountain ranges which form its northern border along the low-lying desert regions of Central Asia.

It thus appears that the Himalaya, with its prolongation west of the Indus, constitutes in reality the broad mountainous slope which descends from the southern border of the great Tibetan table-land to the lower levels of Hindustan and the plains of the Caspian; and that a somewhat similar mountain face, descending from the northern edge of the table-land, leads to another great plain on the north, extending far to the eastward, to the northern borders of China. Toward its north-west extremity this great system is connected with other mountains—on the south, with those of Afghanistan, of which the Hindu-Kush is the crest, occupying a breadth of about 250 miles between Pesháwur and Kúndúz; and on the north, with the mountains that flank the Jaxartes or Sir on the north, and the Thian-shan or Celestial Mountains. The eastern margin of Tibet descends to western China, and the southeastern termination of the Himalaya is fused into the ranges which run north and south between the 95th and 100th meridians, and separate the rivers of Burmah, Siam and western China.

The average level of the Tibetan table-land may be taken at about 15,000 feet above the sea. The loftiest points known on the earth's surface are to be found

along its southern or Himalaya boundary; one of them falls very little short of 30,000 feet in elevation, and peaks of 20,000 feet abound along the entire chain. The plains of India which skirt the Himalayan face of the table-land, for a length of rather more than 1,500 miles, along the northern border of British India, nowhere rise so much as 1,000 feet above the sea, the average being much less. The low lands on the north, about Kashgar and Yarkend, have an elevation of from 3,000 to 4,000 feet, and no part of the Central Asiatic desert seems to fall below 2,000 feet, the lake of Lobnor being somewhat above that level. The greatest dimension of the Tibetan mountain area from east to west may be about 2,000 miles, while its average breadth somewhat exceeds 500 miles; about 100 miles on either side constitute the sloping faces, the central table-land having a width of about 200 miles on the west and probably 500 miles at its eastern border.

The southern portion of the Tibetan table-land throws off its waters to the northwest and southeast from a central line almost on 82° E. longitude, the Indus flowing in the former direction, and the Brahmaputra in the latter. These two rivers maintain their courses for a great distance in opposite ways, longitudinally, along the summit of the table-land; they receive as they proceed the drainage of a large portion of its surface; and their accumulated waters are at length discharged by two openings in the Himalayan slope across the plains of Hindustan into the Indian Ocean.

The northern provinces of British India occupy the great plain which flanks the Himalaya on the south, along its whole extent from the issue of the Brahmaputra on the east to the ranges that lie along the Indus. The whole tract, excepting Assam, *i.e.*, the valley of the Brahmaputra, is highly cultivated and populous; and with the same exception the population throughout is of the race known as Aryan, being almost exclusively Hindu in religion on the east, but passing into Mahometan on the west.

The most eastern portion of the Himalayan mountain slope, as far as the 92d meridian, is occupied by wild tribes of which, or of the country they occupy, little is known. They are in small communities under petty chiefs, and their languages, which vary considerably in detail, are to some extent allied to Tibetan and monosyllabic. Between the 92d and 89th meridians is the small state of Bhotán, the local name of which is "Lhopato." It approximates in language, customs and religion to Tibet proper, and its government is carried on by two separate chiefs, temporal and spiritual. Its northern border, where it is met by Tibet, lies along the 28th degree of north latitude. The small British district of Sikim succeeds, occupying the lower part of the basin of the Tista river, and having Darjeling as its chief settlement. The native state of Sikim, in Tibetan called "Demojong," extends north of British Sikim to Tibet; it is almost as Tibetan as Bhotán, and still less important. Its western border falls nearly on the 88th meridian.

From the 88th nearly to the 80th meridian the whole southern slope is occupied by the kingdom of Nepál, which since the wars with the British in 1814-16 has retained complete independence.

The Káli or Sárda river forms the boundary between Nepál and the British provinces of Kumaon and Garhwal, the chief town in which is almora, and which occupy the entire mountain face, from the watershed to the plains, as far as the main stream of the Ganges, for a distance from east to west of about 100 miles. Thence, an equal distance brings us to the Sutlej, the intermediate tract being occupied by many small principalities, independent in their civil government.

but entirely under political control of the British. In this region is situated Simla, the summer capital of the government of British India, on one of the outer ranges overlooking the Sutlej. Other small districts and principalities, partly British, occupy the Himalayan slope as far as the 76th meridian.

The population of the whole of the mountain districts west of Nepál maintains to a great extent its Hindu type, though the Mahometan religion gradually becomes more prevalent as we approach the Indus, where it is found to have superseded Hinduism. In the more remote and elevated valleys an infusion of Tibetan race, religion, and language is found, diminishing as we pass to the west; but otherwise the dialects spoken are everywhere Prakritic, and closely allied to Hindi. As a rule the people are short in stature, muscular, as is common among mountaineers, fairer than the inhabitants of the plains, and in the western regions, where the Hindu or Aryan stock prevails, women of remarkable beauty are often seen. At the lower altitudes cotton clothing is usual, at the greater elevations hempen and woolen materials prevail, but an utter disregard of personal cleanliness is universal. Goitre is frequent in both sexes, and cretinism seems to occur much in the European form.

The eastern ranges are wetter, the climate generally warmer and more equable, and the vegetation more rank and of a more tropical character; the mountains are more copiously covered with forest, and the extent of cultivation is less, and the population probably less also. To the west, with a drier atmosphere and greater variations of temperature, the climate above 5,000 or 6,000 feet becomes more like that of southern Europe, and the main features of the scenery become more conspicuously similar to those of European mountains. On the east the customs of the people differ little from those of the neighboring Tibetan or semi-Tibetan provinces. On the west there is no great distinction between the people of the hills and of the plains in their customs, agriculture, or other occupations.

The summit of the table-land from the borders of China to the 75th meridian, where the Indus suddenly turns off to the south, is comprised in Tibet, or as it is called in the language of its inhabitants "Bod" or "Bodyul," the latter word being equivalent to "Bod-land." Of the eastern half of Tibet very little is known, and that little chiefly relates to the most southern portion which borders on the Himalaya, and the most eastern which abuts on China. The table-land here has its greatest development, and is perhaps as much as 500 miles from north to south. At its northwestern end its breadth is reduced to something under 200 miles. The extreme cold and drought make Tibet essentially poor; and the character of its inhabitants approaches that of the denizens of the Arctic regions, who live under somewhat similar physical conditions. The people are broadly built, with a strongly-marked Mongolian physiognomy, dark hair, little or no beard, oblique eyes, and prominent cheek bones. In the warmer valleys they are mainly agricultural, and live in houses; in the higher regions they are shepherds, living in tents, thinly scattered over a large area.

To the west of Tibet the mountains are prolonged to the 70th meridian at an elevation not greatly less than that which prevails eastward, and the table-land there ends in the region known as Pamir, which has all the characteristics of the higher parts of Tibet. Beyond this we pass into Turkestan and reach the limits by which the scope of the present article is restricted.

The great plain of northern India stretches with an almost unbroken surface along the foot of the Himalaya

from the upper Indus to the head of the delta of the Ganges, and thence has a narrow prolongation along the Brahmaputra up the valley of Assam. Including its extensions to the sea, along the Indus on the west, and along the Ganges on the east, its area is about 500,000 square miles. It nowhere rises to more than 1,000 feet above the sea-level, and to the unassisted eye it appears a perfectly dead flat. That part of the plain which lies along the foot of the mountains, and more particularly the central and eastern portion, is well watered, being intersected by the numerous streams that flow from the mountains, and under the full influence of the periodical rains, and it comprises the best cultivated, the richest, the most populous, and most civilized districts of India.

The transition from the plains to the mountains is sudden and well-defined along a line that is almost continuous. The ranges to which geologists have given the name of "Siwálik," and "sub-Himalayan," rise abruptly, and without any intermediate undulating ground from the apparently level surface of the plain. These hills, which from recent geological investigation we learn to be formed of deposits of various periods of the Tertiary epoch, attain elevations from a few hundred to 3,000 or 4,000 feet.

The sub-Himalayan ranges have a well-defined distinct geographical existence along the greater part of the chain, and their geological continuity is established where no valley is formed between them and the inner ranges, and where they cannot be otherwise distinguished from the general mass of mountains.

The ranges which lie immediately within the external band of the Siwáliks, or sub-Himalaya, rise abruptly above it to much greater elevations; and constitute the first masses which in such a region we can with propriety dignify with the name of mountains. Their ordinary elevation is about 7,000 feet, and the highest summits on them reach 8,000 or 9,000 feet above the sea. It is on them that sanitary stations have been established for the convenience of the European residents in the neighboring provinces of India, as affording the nearest sites to the plains at which a temperate climate can be reached.

The highest known peak in the Himalaya, and indeed in the world, is that in Nepál known as Mount Everest, which rises to 29,002 feet. Kinchinjinga, in Sikim, on the east, reaches 28,156 feet, and another peak more recently measured, in the extreme west, reaches 28,278 feet. Dháwalagiri, in Nepál, is stated to be 26,826 feet, and Nandadevi, in Kumaon, to be 25,700 feet above the sea. But many other points have been measured exceeding 25,000 feet in elevation, two of which are to the north of Kumaon; and the enumeration of all known peaks over 20,000 feet would be wearisome. These statements have reference to the particular zone along the Indian watershed above described, beyond which, as was before said, few measurements have been made (excepting in Ladák), but there is every reason to believe, from such scanty facts as are available for forming an opinion, that mountains rising considerably above 20,000 feet are of frequent occurrence throughout Tibet.

HIMERA, a city on the north coast of Sicily. It was founded in 648 B.C. by the Chalcidian inhabitants of Zancle, but with them were many Syracusan exiles, who gave to the language of the city a Doric character. It seems to have enjoyed great prosperity during the fifth century. In 415 it refused to admit the Athenian fleet, and was a zealous ally of Syracuse. In 408 the Carthaginians sent another great army, under Hannibal, grandson of Hamilcar, who razed the city to the ground.

HIMMEL, FREDERICK HENRY (1765-1814), a Ger-

man composer, was born November 20, 1765, at Treuenbrietzen, in Brandenburg, Prussia, and originally studied theology at Halle. He died at Berlin, June 8, 1814.

HINCKLEY, a market town of England, county of Leicester, is situated thirteen miles southwest of Leicester, on a branch line between that town and Nuneaton, which connects the London and Northwestern and the Midland railways. Population, 7,000.

HINCMAR (c. 806–882), archbishop of Rheims from 845 to 882, a prominent figure in most of the theological and ecclesiastical struggles of his day, and perhaps the most vigorous and influential prelate France has ever produced, belonged to a noble West Frankish family, and was born about the year 806, and died in 882.

HINDLEY, a manufacturing town of Lancashire, is situated on the Lancashire and Yorkshire railway, three miles southeast of Wigan. Cotton-spinning and the manufacture of cotton goods are the principal industries, and there are extensive coal-mines in the neighborhood. Population, 12,000.

HINDOL, one of the tributary states of Orissa, India. It is surrounded on all sides by native states, being bounded on the north and east by Dhenkánal, on the south by Barambá and Narsinhpur, and on the west by Angul. Area, 312 square miles. Population, about 30,000.

HINDÚ KÚSH is a title applied to the line of alpine watershed stretching west-southwest from the southern margin of Pamir, the Caucasus of Alexander's historians, which divides Afghanistan in a general sense from Afghan Turkestan, and the basin of the Cabul river from the basin of the Oxus. Looking toward the heart of a map of Asia, the eye is caught by that remarkable point where the great highland seems clenched as it were to a knot, whence expand in different directions (1) to east and southeast the great Tibetan plateau, (2) to north that of Pamir, and (3) to west that of Khorasan and Persia. Between the diverging masses run up the great basins of the Indus, the Yarkand river, and the Oxus. Some dim memory of these great features perhaps, transformed and transplanted further east, appears in the cosmography of the Puranas, in which the mythical Ganges falling on Mount Meru divides into four great rivers flowing to the cardinal points.

This is the first impression. But, imperfectly as we yet know the mountain structure, the more we learn the more evanescent becomes this idea of triplicity as typifying the true skeleton. This node is in fact the place of contact or intersection of two great elevations:—(1) of the Himalaya, of which the axial lines approach in a direction southeast to northwest; and (2) of the Thian-Shan and allied ranges, of which the axial lines run from east-northeast to west-southwest. The parallelism of Hindú Kúsh seems to attach it to the latter system.

The definition of geographical features must often be in part arbitrary, but that of Hindú Kúsh fairly coincides with natural limits. On the east we take it as commencing at the Baroghil Pass, leading from the high valley of Little Pamir south into the valley of Káshgár or Chitral. Just east of this is a cluster of peaks of great altitude, but their alignment attaches them to the great Gilgit range of the Himalaya. On the west we regard Hindú Kúsh as including and terminating at the Hajjigak Passes, those most commonly used between Cabul and Turkestan. West of this the range continues as a watershed of considerable altitude, but with a partial change of direction and loss of true alpine character. In maps this prolongation is styled Koh-i-Baba. Properly Koh-i-Baba is the name of a conspicuous three-peaked mountain rising over the Hajjigak Pass, to a height of at least 16,500 feet, which we regard as the terminal prominence of Hindú Kúsh,

though it is in truth also isolated from the higher summits to the eastward, which especially claim that name, by a considerable interval of tamer mountain, rounded and naked.

The total length of Hindú Kúsh as thus defined is 365 miles. Toward the eastern extremity the watershed perhaps emerges little from the table-land, for the Baroghil Pass is of singularly easy acclivity on both sides, and no prominent summits adjoin it on the west. But for the rest of its extent the mountain tract of Hindú Kúsh realizes the popular idea of an alpine chain, *i.e.*, of an unpierced mountain barrier whose passes are never far below the line of perpetual snow, and whose highest peaks are never very far from the watershed.

The general altitude of the "cols" or passes runs from 12,000 to 13,000 feet.

HINDUR, also called **NALAGARH**, one of the Punjab hill states, under the government of the Punjab, India. Area, 256 square miles. The country was overrun by the Ghoorkas for some years prior to 1815, when they were driven out by the British, and the rájá confirmed in possession of the territories. The estimated population is 70,000. The principal products are opium and the usual grains.

HINDÚSTAN. See **INDIA**.

HINDUSTANI, or **URDU**, is a dialect of the Hindi, one of the seven languages of Aryan stock spoken at the present day in North India, the others being the Panjābī, Sindhī, Gujarāti, Marāthī, Bangālī, and Oriyā. The area over which it is spoken in North India may be said to be coëxtensive with that of the Hindī, which is estimated at about 250,000 square miles extending from the river Gandak in the east to the Sutlej in the west, and from the Himālaya in the north to the Vindhya mountains in the south. It is also extensively used, though in a somewhat different phase, in a great part of the Deccan, and is moreover the *lingua franca* of most parts of India.

As the Hindī language consists of many dialects, it is necessary to state that it is the Braj Bhāshā, or the dialect that is spoken in the districts of Agra and Mathura, and in the neighborhood of Dehlī, the ancient capital of the Mohametan empire, which is generally regarded as the parent of Hindústānī. The grammatical structure and also a vast number of the commonest vocables of the Braj were incorporated in the new dialect, and to these were added a vast number of Persian, Arabic, and even Turkish words. Such words, however, in no wise altered or influenced the language itself, which, as regards its inflectional or phonetic elements, remains still a pure Aryan dialect, just as pure in the pages of Walī or Saudā, as it is in those of Tulsī Dās or Bihārī Lāl.

As regards the introduction of foreign words into the various dialects of Hindī, it seems highly probable that it had its origin at an early period, perhaps as early as the eighth or ninth century of our era. But there is good ground for the opinion that, although the Hindī area was overrun as early as the twelfth century, the Hindústānī was not formed till the sixteenth century. For many generations after the victories of Kutbu'd-dīn Aibak, the first Musalmān sovereign of Dehlī, the conquerors retained their own Persian, and the conquered their Hindī. The Musalmāns had long been accustomed to speak pure Hindī, and it was not they who introduced Persian words into the language, but the Hindūs themselves, who at the epoch above mentioned were compelled by Todar Mal's new revenue system to learn Persian. And we learn from Mīr Amman of Dehlī (whose brief account of the origin of Urdū in the preface to his well-known *Bāgh-o-Bahār* bears on the face of it every convincing mark of probability, and,

scanty as it is, is remarkable as, perhaps, the only attempt at a critical disquisition in the whole range of Hindūstānī literature) that at the date of the composition of his work (1802) the Musalmān dynasties had endured for a thousand years, and that as intercourse increased the languages of the Hindūs and Musalmāns became to a certain extent mixed.

The epoch of Akbar, which first saw a regular revenue system established, with toleration and the free use of their religion granted to the Hindūs, was, there can be little doubt, the period of the formation of the language. But its final consolidation did not take place till the reign of Shah Jahān. After the date of this monarch the changes are comparatively immaterial until we come to the time when European sources began to mingle with those of the East. Of the contributions from these sources there is little to say. Like the greater part of those from the Arabic and Persian, they are chiefly nouns, and may be regarded rather as excrescences which have sprung up casually and have attached themselves to the original trunk than ingredients duly incorporated in the body.

The grammatical structure of the Hindūstānī differs in no essential particular from that of the Hindī from which it is sprung. Of the history and development of the Hindī or Hindū language previous to the eleventh century of our era little or nothing is known. It is accepted as a fact by most scholars that Sanskrit ceased to be a vernacular in the sixth century B.C., when the Buddhist religion was founded, which for ten centuries drove Brāhmanism into obscurity. From that time the Aryan people of India spoke popular dialects called Prākritis, and it is from these that time modern Aryan tongues are mainly derived. The dawn of modern Hindī may be dated from the eleventh century. The earliest known writer in the language was Chand Bardāi (c. 1200), whose epic is in a dialect rude and half-formed, but as decidedly analytical as the Hindī of the present day. Much of the old synthetical structure no doubt is still to be found in the work; the particles and auxiliary verbs are in a very crude and unformed state; but these crudities and remnants of old Prākrit forms do not affect the general structure.

HINDUSTANI LITERATURE. Hindustani literature falls into two great divisions, of which the first is comprehensively styled Hindī, the second Urdū. Both of these forms of speech are, in their application to literary purposes, at first intruders upon the ground already occupied by the learned languages, Sanskrit and Persian. At no time during modern Indian history has Sanskrit altogether ceased to be used for composition by the class who regard culture and literature as their special heritage, although during the last two centuries it has much fallen from its former estate; and Persian has been still less neglected by learned Muhammadans and their Hindu imitators in India. But there is this difference between them that, whereas Hindī has been raised to the dignity of a literary language chiefly by impulses of revolt against the monopoly of the Brahmins, Urdū has been cultivated with good will by authors who have themselves highly valued and dexterously used the polished Persian. Both, however, represent the popular side of the national culture, and in the present day they are almost in sole possession of the field. The subject may be divided as follows:

Early Hindī, of the period during which the language was being fashioned as a literary medium, represented by the old heroic poems of Rājputānā and the literature of the *Bhagats* or Vaishnava reformers, and extending from about 1200 to 1570 A.D.

Middle Hindī, representing the best age of Hindī poetry, and reaching from about 1570 to 1750 A.D.

The rise and development of literary Urdū, beginning about the end of the sixteenth century and reaching its height during the eighteenth.

The modern period, marked by the growth of a prose literature in both dialects, and dating from the beginning of the present century.

Early Hindī literature has as yet been very insufficiently explored.

The *origines* of Urdū as a literary language are extremely obscure. The popular account refers its rise to the time of Timūr (1398). Some authors even claim for it a higher antiquity, asserting that a *dīwān* or collection of poems, was composed in *Rekhtah* by Mas'ūd, son of Sa'd, in the last half of the eleventh and beginning of the twelfth century, and that Sa'dī of Shīrāz and his friend Amīr Khusrau of Dehli likewise made verses in that dialect before the end of the thirteenth century. This, however, is very questionable; and the better opinion appears to be that these ancient compositions, if they existed at all, were written in Hindī according to the metrical forms of that language, rather than in what is properly called Urdū. That Muhammadans composed in Hindī, and used that language as their vernacular, is certain; and in many passages of Kabīr, which are nevertheless pure Hindī compositions, Persian words are used almost as freely as in the modern dialect. Much of the confusion which besets the subject is due to the want of a clear definition of what Urdū, as opposed to Hindī, really is.

Urdū, as a literary language, differs from Hindī rather in its form than in its substance. The really vital point of difference, that in which Hindī and Urdū are incommensurable, is the prosody.

The whole of Urdū poetry follows Persian models of composition; its themes are those which had already been worked (some might say, worked out) by writers in that language; and neither in form nor substance do we find the faintest flavor of originality from its commencement to the present day.

The paucity of themes and the want of originality in the Urdū verse have led to a most elaborate development of the system of rhetoric. Where the substance of what a poet has to say is identical with that which has been said by hundreds, nay thousands of poets before him, it is of the highest importance that the way of saying it shall if possible be peculiar to himself. Rhetoric, accordingly, rather than poetic feeling, is the distinguishing feature of composition in Urdū.

Printing was first used for vernacular works by the College Press at Fort William, and all the compositions prepared for Doctor Gilchrist and his successors which have been already mentioned were thus made public; but the expense of this method of reproduction long precluded its extensive use in India, and the ungraceful characters used as types were not appreciated by the natives. In 1837 the first lithographic press was set up at Dehli, and from that date onward the publications, original or editions of older works, issued in this shape annually may be counted by hundreds. The newspaper press soon followed the introduction of lithography, and there are at present about two hundred journals in Urdū and Hindī printed in India, the majority in the Northwestern Provinces, the Panjāb, and Oudh, but a few at Madras, Haidarābād, Bangalore, Bombay, and Calcutta. The extension of vernacular literature during the last thirty years is enormous, and to describe it adequately would require a volume.

English education has naturally had a vast influence on modern vernacular literature, though not wholly a beneficial one. More than a half of the new works issued within the last thirty years are translations or adaptations from English; the journals, the great popu-

larizers of new ideas, take their matter chiefly from English newspapers; the courts, where Urdū has since 1832 become the official language, contribute to the spread of the stiff and difficult phraseology of the Acts of the legislature, as different from the natural idiom of the people as can well be imagined.

HINGANGHÁT, a town in the Wardha district, Central Provinces, India, twenty-one miles southwest of Wardha, with a population of 9,415. It is a main seat of the cotton trade, the Hinganghát cotton produced in the rich Wardha valley being esteemed one of the best indigenous staples of India.

HINOJOSA DEL DUQUE, a town of Spain, in the province of Cordova, from which city it is distant about fifty-eight miles north by west. The manufacture of linens and woollens is carried on to some extent. Population, 8,500.

HINTON, JAMES, aural surgeon and author, son of John Howard Hinton, Baptist minister and author of the *History and Topography of the United States* and other works, was born at Reading, England, in 1822. He was educated at his grandfather's school near Oxford, and at the Nonconformist school at Harpenden. After receiving his diploma in 1847, he was for some time assistant surgeon at Newport, Essex, but the same year he went out to Sierra Leone to take medical charge of the free laborers on their voyage thence to Jamaica. After his return to England in 1850, he entered into partnership with a surgeon in London, where he soon had his interest awakened specially in aural surgery, and gave also much of his attention to physiology and to problems bearing on the relation between mind and body. He made his first appearance as an author in 1856 by contributing a series of papers on physiological and ethical subjects to the *Christian Spectator*. In 1863 he obtained the appointment of aural surgeon to Guy's Hospital, after which he speedily acquired a lucrative west-end practice, and wrote *An Atlas of Diseases of the Membrana Tympani* and *Questions of Aural Surgery*, which are regarded as the chief authorities in this branch of surgery. He died December 16, 1875.

HIOGO, or FIOGO, a seaport town of Japan, in the island of Nipon and province of Setsu, on the western shore of the Idzumi Sea, or Bay of Osaka, about forty miles southwest of Kioto, with which it has had railway communication since 1874. It was opened to foreign commerce in 1860, and since that date it has risen with the maritime suburb of Kobe (the Gate of God) to be a place of 50,000, or, according to other authorities, 80,000 or 90,000 inhabitants. Its harbor, formerly dangerous, has, by the construction of a costly breakwater, been rendered one of the most serviceable in the kingdom.

HIPPARCHUS, the founder of mathematical astronomy, was born at Nicæa in Bithynia. The years of his birth and death are both unknown, but the period of his activity, according to the evidence of his observations, which have been preserved by Ptolemy, must have been between 160 and 125 B.C.

HIPPEL, THEODOR GOTTLIEB VON, a German author, known chiefly as a humorist, was born on January 31, 1741, at Gerdaun in East Prussia, where his father was rector of a school. In his sixteenth year he went to Königsberg to study theology and also studied law. He was successful in his profession, passing from one grade to another, until in 1780 he was appointed burgomaster and director of police in Königsberg, and in 1786 privy councilor of war and president of the town. To write books in his country house near Königsberg was his favorite amusement, and some of them have still a certain popularity. Perhaps the best known is his *Ueber die Ehe*

(Concerning Marriage). He has also works on *The Social Improvement of Woman*, and on *Female Education*. He died on April 23, 1796, leaving a considerable fortune.

HIPPO. See BÔNE.

HIPPOCAMPUS, or SEA-HORSE. The small fishes thus named constitute, together with the Pipe-fishes or *Syngnathi*, a distinct order of the class of fishes, that of Lophobranchs or fishes with the gills arranged in tufts. The name "Sea-horse" has been given from the singular horselike shape of the head and fore-part of the body. The head is compressed, and is prolonged into a flat snout, at the end of which opens the small mouth. The eye occupies the same position as in the horse, and the head is joined at an angle to a narrow and curved neck, which posteriorly is dilated into the broader body. As in all the fishes of this order, the body is not covered with soft skin or scales, but incased in a mail composed of hard and tough scutes, which are of a more or less quadrangular shape, and generally armed with tubercles or spines. The tail is long, flexible and prehensile, without caudal fin. These fishes are very bad swimmers, their locomotion being entirely dependent on the long dorsal fin which slowly propels them by a rapidly undulating screw-like motion; placed in the middle of the back of a body which generally occupies a vertical or oblique position in the water, this order of locomotion has a propelling power far inferior to that of a terminal caudal fin. By means of their prehensile tail the sea-horses attach themselves to the stems of seaweed or corals, which they resemble so closely in their outward appearance that it is difficult to distinguish them,—a resemblance which is still more increased in a group of sea-horse (*Phyllopteryx*) in which many of the spines and tubercles bear long tapering bands like the fronds of seaweeds.

HIPPOCRATES, termed the "Father of Medicine," was born, according to Soranus, in Cos, in the first year of the 80th Olympiad, *i.e.*, in 460 B.C. He was a member of the family of the Asclepiadæ, and was believed to be either the nineteenth or seventeenth in direct descent from Æsculapius. It is also claimed for him that he was descended from Hercules through his mother, Phænarete. He studied medicine under Heraclides, his father, and Herodicus of Selymbria; in philosophy Gorgias of Leontini and Democritus of Abdera were his masters. His earlier studies were prosecuted in the famous Asclepion of Cos, and probably also at Cnidos. He traveled extensively, and taught and practiced his profession at Athens, probably also in Thrace, Thessaly, Delos, and his native island. He died at Larissa in Thessaly, his age being variously stated as eighty-five, ninety, one hundred and four and one hundred and nine. The incidents of his life are shrouded by uncertain traditions, which naturally sprang up in the absence of any authentic record; the earliest biography was by one of the Sorani, probably Soranus the younger of Ephesus, in the second century; Suidas, the lexicographer, wrote of him in the eleventh, and Tzetzes in the twelfth century. In all these biographies there is internal evidence of confusion; many of the incidents related are elsewhere told of other persons, and certain of them are quite irreconcilable with his character, so far as it can be judged of from his writings and from the opinions expressed of him by his contemporaries; we may safely reject, for instance, the legends that he set fire to the library of the temple of health at Cnidos, in order to destroy the evidence of plagiarism, and that he refused to visit Persia at the request of Artaxerxes Longimanus, during a pestilential epidemic, on the ground that he would in so doing be assisting an enemy. He is re-

ferred to by Plato as an eminent medical authority, and his opinion is also quoted by Aristotle. The veneration in which he was held by the Athenians serves to dissipate the calumnies which have been thrown on his character by Andreas, and the whole tone of his writings bespeaks a man of the highest integrity and purest morality.

HIPPOLYTUS, an ecclesiastical writer belonging to the first half of the third century. Of the details of his life little that is authentic is known. He appears to have been born in the latter half of the second century. From the fact that he employs Greek as his mother tongue, it has been supposed that he belonged to the eastern portion of the Roman empire; but this conclusion is by no means stringent, and there are various indications in his writings that he had passed some at least of his early years in Rome. As regards the close of his life our most trustworthy information is derived from the chronographer of 354 (Mommson *Ueber den Chronographen vom Jahre 354*, Leipsic, 1850), according to whom "the presbyter" Hippolytus in the time of Alexander Severus (235) was banished along with the Roman bishop Pontianus to Sardinia, where, it seems to be suggested, he died.

HIPPOLYTUS, St., according to the Roman breviary, was one of St. Lawrence's converts, who, when summoned before the emperor Valerian on account of the practice of his religion, made a public profession of Christianity. First beaten with rods, he was finally delivered over along with all his family to death, the mode of execution in his case being similar to that by which Hippolytus the son of Theseus perished.

HIPPONAX, of Ephesus, a poet placed third, after Archilochus and Simonides, among the classic iambic poets of Greece. Expelled from Ephesus in 540 B.C. by the tyrants Athenagoras and Comas, he took refuge in Clazomenæ. There his deformed figure and malicious disposition exposed him to the caricature of the Chian sculptors Bupalus and Athenis; and he revenged himself by issuing against them a series of satires.

HIPPOPOTAMUS, a family (*Hippopotamidae*) of artiodactyle ungulate mammals comprising two genera, each containing a single living species. Of these the best known is the hippopotamus, occurring only in Africa, where it abounds in many of the river courses. It is a huge, unwieldy creature, measuring in the largest specimens fully fourteen feet from the extremity of the upper lip to the tip of the tail, while it ordinarily attains a length of twelve feet, with a height of five feet at the shoulders, and a girth round the thickest part of the body almost equal to its length. Its remarkably small ears are exceedingly flexible, and are kept in constant motion when the animal is seeking to catch a distant sound. Its eyes are placed high up on the head, and but little below the level of the ears; its gape is wide, and its upper lip thick and bulging so as to cover over even the largest of its teeth when the mouth is closed. It is provided with a considerable number of molar teeth adapted for grinding vegetable substances, and a formidable array of long spear-like incisors and curved chisel-edged canines or tusks which, according to Baker, root up the rank grass like an agricultural implement. Its legs are short, so that the body is but little elevated above the ground; and its feet, which are small in proportion to the size of the animal, terminate in four short toes each bearing a small hoof. With the exception of a few tufts of hair on the lips, on the sides of the head and neck, and at the extremity of the short robust tail, the skin of the hippopotamus, some portions of which are two inches in thickness, is entirely destitute of covering. It is usually of a dark fleshy red color, irregularly marked with blackish spots. The

hippopotamus is a gregarious animal, living in herds of from twenty to forty individuals on the banks and in the beds of rivers, in the neighborhood of which it most readily finds its appropriate food. This consists chiefly of grass and of aquatic plants, of which it consumes enormous quantities, the stomach of one of those creatures being capable of containing from five to six bushels. They feed principally by night, remaining in the water during the day, although in districts where they are little disturbed by man they are less exclusively aquatic. In such remote quarters they put their heads boldly out of the water to blow, but when rendered suspicious by man's persecution, they become exceedingly cautious in this respect, only exposing their nostrils above the water, and even this they prefer doing amid the shelter of water plants. In spite of their enormous size and uncouth form, they are expert swimmers and divers, and can, it is said, remain easily under the water from five to eight minutes. They are also said to walk with considerable rapidity on the bottoms of rivers, beneath at least a foot of water. At nightfall they come on land to feed; and when, as often happens on the banks of the Nile, they reach cultivated ground, they do immense damage to growing crops, destroying by their ponderous tread even more than they devour. To scare away those unwelcome visitors the natives in such districts are in the habit of kindling great fires at night. Although they do not willingly go far from the water on which their very existence depends, occasionally they have been found to travel long distances by night in search of food, and in spite of their clumsy appearance they are able, according to Baker, to climb up steep banks and precipitous ravines with astonishing power and ease.

The hippopotamus does not confine itself to rivers only, but when opportunity occurs of exercising choice it has been known to prefer the waters of the ocean as its home during the day. Of a mild and inoffensive disposition, it seeks to avoid collision with man; when wounded, however, or in defense of its young, it is wont to exhibit the greatest ferocity, and the native canoes are frequently capsized and occasionally demolished by its infuriated attacks, its usual bellowing grunt then becoming loud enough to be heard a mile away. As among elephants, so also among hippopotami there are "rogues"—old bulls which, having been expelled from the herd, have become soured in solitude; these are at all times dangerous. Assuming the offensive on every occasion, they attack all and sundry without shadow of provocation; the natives, therefore, are careful to avoid the haunts of those *solitaires*, which are usually well known.

The rifle of the European has proved the most potent destroyer of the hippopotamus; but to prove effective it must be aimed at the head, the most vulnerable points in that region being immediately behind the ear and in the eye. Everywhere regarded as a valuable prize, the natives employ a variety of methods in order to secure it, the most common of these being the use of an iron harpoon attached to a line.

Another native method of destroying those animals is by means of a trap known as the "downfall," consisting of a heavy wooden beam armed at one end with a poisoned spearhead and suspended by the other to a forked pole or overhanging branch of a tree.

The female is less in size than the male, and is exceedingly shy, taking to the water with her young, which she usually carries astride on her neck, on the slightest alarm. It is only after long practice that the young become able to remain as long under the water as their parents, and for this reason the females while tending them come much oftener to the surface than their own necessities require. The period of gestation, as observed

in females confined in the Zoölogical Gardens of London and Paris, extends to nearly eight months; the young reach maturity in five years; and the full term of life in the species is believed to extend to thirty years. The male hippopotamus which died some years ago in the Zoölogical Gardens, London, was captured in August, 1849, when only a few days old; it had thus nearly attained the age of twenty-nine, while an examination of its dead body disclosed, says Professor Owen, "no special morbid appearance to suggest that death from old age had been anticipated." The flesh of the hippopotamus is generally considered a delicacy, both by natives and colonists, although, according to Livingstone, there are certain tribes on the Zambesi who have as great an abhorrence of hippopotamus meat as Mohammedans have of swine's flesh.

The skin of the hippopotamus is turned to profitable account in the manufacture of elastic whips, which are in great demand throughout the African continent. The skin, according to Schweinfurth, when fresh is cut into long quadrilateral stripes, which when half-dried are trimmed with a knife and afterward hammered out, like iron on an anvil, into round whips. As several hundreds can be made from a single hide, that part is of considerable commercial value. Still more valuable are the tusks and incisor teeth, which, from their extreme hardness and the fact that they do not readily become yellow, are now largely used in the manufacture of artificial teeth. The hippopotamus formerly abounded in such rivers as the Nile, the Niger, the Senegal, and most of the rivers of South Africa. It is now, however, becoming gradually more restricted in its distribution, having disappeared altogether from the Egyptian Nile,—although still abundant in its Abyssinian tributaries,—as well as from the rivers of Cape colony.

The Liberian hippopotamus (*Charopsis liberiensis*), the only other existing member of the family, is exceedingly rare, having been only known until recently from the two skulls on which the genus and species were founded. It differs from the common species in possessing only one pair of incisors in each jaw instead of two, and in several other minor points. A few years ago a young specimen of this rare species was brought alive to England from the Scarcies river, north of Sierra Leone, but it died soon after landing. The species is found on the west coast of Africa and on certain of the rivers flowing into Lake Chad.

Although there are thus only two living species, both of which are confined to Africa, the hippopotamus family was both larger and more widely distributed in former periods of the earth's history, fossil remains of at least nine species having been found in the Tertiary deposits of Europe and India. In Europe they occur as far north as Belgium and the south of England, but they are found nowhere in such abundance as in the island of Sicily, from which they were formerly exported in shiploads to England and France, where they were used in the manufacture of lampblack and manure. The occurrence of those animals in a place which they could not possibly have reached had it always been an island, is regarded as one of the many proofs that dry land existed during some portion at least of the Tertiary period between Italy and Africa.

HIRING, in law, may be defined as a contract by which one man grants the use of a thing to another in return for a certain price. It corresponds to the *locatio-conductio* of Roman law. That contract was either a letting of a thing (*locatio-conductio rei*) or of labor (*locatio operarum*). The distinguishing feature of the contract was the price. Thus the contracts of *mutuum commodatum*, *depositum* and *mandatum*, which are all gratuitous contracts, become, if a price is fixed, cases of

locatio-conductio. Hiring, in its modern acceptation, would generally be applied to contracts in which the services of a man or the use of a thing are engaged for a short time and does not apply to real estate, for which the equivalent term would be "renting."

HIRSCHAU, or HIRSAU, a village within the amt of Calw and the circle of Schwarzwald, Württemberg, on the Nagold, is a station on the Pforzheim-Horb Railway, and has paper and other manufactories.

HIRSCHBERG, the chief town of a circle in Prussian Silesia, government district of Liegnitz, is beautifully situated at the confluence of the Bober and Zacken, and on the Silesian mountain railway thirty miles southwest of Lauban by rail.

HIRTIUS, AULUS, one of Cæsar's chief supporters and most intimate friends. He was with him as *legatus* in Gaul. After the civil war broke out in 49 B.C., he seems to have been generally stationed in Rome to protect Cæsar's interests there. On March 27, 43, after Cæsar's death a double battle was fought at Mutina between Antony and the senatorial party. In the first Antony had the upper hand, and Pansa was mortally wounded; and in the second Hirtius completely defeated the enemy, but was himself killed in the subsequent assault on the enemy's camp.

HISPANIOLA. See HAYTI.

HISSÁR, British district belonging to the division of the same name, in the lieutenant-governorship of the Punjab, India. Hissár forms the western border district of the great Bikaner desert, and consists for the most part of sandy plains dotted with shrub and brushwood, and broken by undulations toward the south, which rise into hills of rock like islands out of a sea of sand. Rice is the staple crop of the district. In favorable seasons, cotton is extensively grown in lands irrigated by the Western Jumna Canal.

HISSÁR, municipal town and administrative headquarters of the above district. Population (1890), 18,576.

HISSAR, a state in Central Asia, dependent on the amir of Bokhara. It forms that part of the basin of the Oxus which lies on the north side of the river, opposite the Afghan province of Balkh.

HISTOLOGY. ANIMAL HISTOLOGY (from *ἱστός*, a web or tissue, and *λόγος*, discourse) is the study of the minute structure of the tissues of animals. By a tissue is meant any part of an organism which has undergone special changes in structure in adaptation to the performance of special functions. These special changes are expressed by the general term "differentiation." In the lowest animal organisms, the whole of whose bodies are composed of the undifferentiated living substance termed "protoplasm," we find all its functions shared by every part of the organism. An amoeba, for example, it is well known, is capable of finding, seizing, devouring, digesting, and assimilating food, has a special provision for collecting fluid and pumping it out of its body, respire by its whole surface, moves about apparently where it will, exhibits a sensibility to tactile impressions, and reacts in all probability to smell if not to sound and light—in short, is capable of performing, although with the lowest possible amount of activity, almost every function which animals vastly higher in the scale of organization exhibit. But even in the amoeba we cannot say certainly that there is no differentiation of its protoplasm. For a condensed portion—the nucleus—is set aside to initiate the reproductive function, and it is by means of the external and firmer layer (ectoplasm) that its movements are effected and its relations with the external world maintained, while the internal more fluid protoplasm (endoplasm) is concerned with the digestion of the

food. Still there are simple organisms whose protoplasm is probably absolutely undifferentiated. On the other hand, there are other organisms which are also regarded as composed of simple protoplasm, and are constituted by a single cell, which nevertheless show a marked progress in the differentiation of portions of their substance apart altogether from the presence of a nucleus. Such differentiation in unicellular organisms generally takes the form of the production of a shell or "test," as in the *Foraminifera* and in *Noctiluca*, which subserves purely passive functions of sustentation or defense. It is not certain in such cases whether the structure thus produced is formed by the direct conversion of the protoplasm or by an exudation on the surface which subsequently hardens. But portions of the protoplasm may be set aside for the performance of *active* functions. We see this in its production in the form of locomotory organs, either temporary (pseudopodia) or permanent (cilia). But in neither of these can any actual change in the minute structure of the protoplasm be observed. A differentiation does, however, occur in one remarkable instance—the flagellum, namely, of the *Noctilucidae*, which exhibits as definite a transverse striation as does the cross-striated or voluntary muscular tissue of the higher animals, in which structural peculiarity it is impossible not to infer a relation to its contractile functions; and similarly, in the *Vorticellidae*, there is a differentiation of the protoplasm of the rapidly contractile stalk.

Whereas in the more highly organized unicellular animals portions of the single cell are thus set aside for the performance of special functions, and modified in structure accordingly, in multicellular animals, on the other hand, we find whole cells and sets of cells set apart and differentiated. It is to such modifications in sets of cells in multicellular organisms, rather than in portions of the protoplasm of a unicellular organism, that "histological differentiation" is commonly restricted; and each such set of cells, destined for the performance of a special function, and modified accordingly in structure, is denominated a "tissue."

The animal tissues may be classed under the four heads of *Epithelium*, *Connective Tissue*, *Muscular Tissue*, and *Nervous Tissue*. Of these four classes of tissue the epithelium is the most primitive and least altered. In the development of the *Metazoa* the numerous embryonic cells which result from the division of the single cell—the ovum—tend in nearly every case to arrange themselves as a single layer surrounding a central cavity (unilaminar condition of the blastoderm). Presently a part of the wall of the hollow sphere become invaginated, so that, instead of a vesicle inclosed by but a single layer of cells, a cup (*Gastrula*, Haeckel), is produced, the wall of which is formed by two layers derived from the original single layer, and separated from one another by a narrow interval (which is all that remains of the original cavity of the vesicle) except at the orifice of the cup, where they are continuous (bilaminar condition of the blastoderm). At this part some cells become separated from one or both of these two primary layers, and, extending in and occupying the cleft-like space which separates them, become a third layer of cells, which differs from those of the other two in not being arranged into a continuous membrane, and not, therefore, forming an epithelium (trilaminar condition of the blastoderm). Now, of these three layers, the outer one, or ectoderm, and the inner one, or entoderm, give rise to all the epithelial tissues of the body. The nervous tissues are also derived from the ectoderm; whereas the connective and muscular tissues originate in the mesoderm or middle layer. In

most of the *Cœlenterata*, however, the mesoderm is not developed at one part only of the embryo as in the higher *Metazoa*. In the hydroid polyps and *Medusæ* it never becomes completely distinct from the ectoderm and entoderm, although a jelly-like sustentacular substance may be formed to a greater or less extent between the two primary layers, and cells may pass into it from one of them, so that a kind of mesoderm is thus produced. In the *Medusæ*, also, the muscular function is performed by cells which either still have their place in the general layer of the ectoderm or are but imperfectly separated from it; and here, again, the commencing separation does not occur at one part only, but over extensive tracts of the surface. Nevertheless these cells are modified in structure precisely in the same way as those which in higher animals are derived from the mesoderm. The nervous functions are also performed by cells and fibers, which, although they show those modifications of structure which in the higher animals are characteristic of nervous tissue, yet remain strictly confined to the ectoderm, and do not, as in the higher animals, penetrate into the mesoderm.

The Epithelial Tissues.—Although the layers of cells which are first formed are layers of epithelium, and, therefore, the epithelial tissues are the first to be produced, nevertheless we find that they undergo less modification in structure than any of the other three classes of tissue. As before said, they invariably consist merely of cells cemented together by an imperceptible amount of intercellular substance, and the cells themselves only show minor degrees of modification in shape and structure, at least as compared with the other tissues constituted mainly of cells, namely, the muscular and nervous.

The Connective Tissues.—The connective tissues are characterized by the great development of intercellular substance in comparison with the cells; indeed in those animals in which connective tissue may first of all be said to appear, there is an entire absence of cellular elements properly belonging to the tissue. This is the case in many of the *Cœlenterata*, in which the connective tissue is represented merely by a layer, more or less thick, of hyaline substance, which undoubtedly performs a sustentacular function, in addition to connecting together the epithelial layers of the ectoderm and entoderm.

The intercellular or ground substance almost invariably takes a prominent part in the formation of connective tissue. It is of a semi-fluid nature, and often contains in addition to albumen a certain amount of mucin. In most cases the cells of the connective tissue separate themselves from the primary layers before the formation of this ground substance; indeed the mesoderm is at first chiefly formed of these cells.

The connective tissues of invertebrates are similar to those of the vertebrate; at the same time it must be admitted that there are not unimportant differences in chemical constitution, such as the absence of a substance yielding gelatin, and the absence for the most part of mucin, both of which are characteristic constituents of vertebrate connective tissue. On the other hand the anatomical characters of the elements, both cells and fibers, are in most cases sufficiently well marked to be recognizable.

The Muscular Tissues of Animals.—In the Vertebrata three kinds of muscular tissue are met with—the plain or involuntary, the cross-striped or voluntary, and the cardiac or heart muscle. Undoubtedly the last-named is to be regarded as a transitional form between the other two, for it combines some of the characters of each. This is especially well seen in the lower vertebrates, in which the muscular fibers of the

heart consist of long, tapering, uninuclear cells, in form resembling the plain contractile fiber-cells, but differing from these and resembling the multinucleated voluntary muscular fibers in exhibiting distinct transverse striations. Although these three kinds of muscular tissue thus differ from one another in this respect, they agree in one important character. Whether transversely striated or not, they all exhibit a distinct longitudinal striation of their substance, which is probably indicative of a popularity which the protoplasm of the cell has assumed at the same time with the faculty of becoming rapidly shortened in the direction of its length and coincidently with the loss of the power of contracting in other directions. Moreover, this longitudinal striation is generally associated with the property of double refraction, which is exhibited to a marked degree by all kinds of muscular tissue.

The muscular fibers of the Invertebrata very closely resemble those of vertebrates. In most cases the differentiation of the muscular substance is not so complete as in the voluntary muscles of vertebrates and especially of mammals, but there is a striking exception in the *Arthropoda*, and especially in insects, where in conformity with the greater muscular activity they possess we find far better marked structural features. On this account the muscles of insects have been especially carefully studied with a view to the elucidation of the structure of muscle generally.

The Nervous Tissues of Animals.—The nervous tissue of vertebrates is composed firstly of cells—the nerve-cells or ganglion-cells—and secondly of nerve-fibers. Most of the nerve-fibers possess a sheath formed of nucleated cells wrapped around the fiber, and in this sheath a peculiar white fatty so-called medullary substance is accumulated in some fibers, so that they are distinguished from the others as the white or medullated fibers. There is reason to believe that every nerve-fiber is connected with at least one nerve-cell, and conversely, that every nerve-cell is connected directly or indirectly with one or more nerve-fibers. Nerve-cells are generally comparatively large solid-looking corpuscles, with a relatively large nucleus and nucleolus, and every developed nerve-cell has either one or two or a greater number of processes, which may or may not be ramified. It is certain that from many nerve-cells one process of the cell passes into and becomes a nerve-fiber. Nerve-cells are always traversed by exquisitely fine fibrils—nerve-fibrils—and these pass out from the cell into its processes. Apart from any sheath which it may possess, a nerve-fiber is composed of one or more nerve-fibrils, which are embedded in a soft interfibrillar substance. The nervous tissue of vertebrates is developed from that part of the ectoderm which occupies the middle of the dorsal surface of the embryo. In the bird and mammal the epithelial cells in this situation become cut off from the general ectoderm by the formation of a groove which subsequently closes over and forms a canal—the neural canal. The innermost ectoderm cells which form the wall of this canal acquire cilia at the end which is turned toward the cavity, while the other end of each cell is prolonged into branching processes which collectively form a network among the deeper lying cells of the wall. The latter multiply considerably, and moreover groups of them grow out from the sides of the neural canal as the roots of the nerves. The nerve-fibers themselves seem to be formed either by the outgrowth of undivided processes from these cells of the neural canal, or by the junction of one elongated cell with others. At any rate the fibers are to be looked upon as outgrowths or prolongations of nerve-cells. But some of the outgrowths of the nerve-cells, instead of passing into nerve-fibers, become ramified, and

eventually break up into fine twigs, each of which is occupied by a nerve-fibril, and these form by their interlacement a network which joins that of the branched processes of the ciliated epithelium.

With the exception of the formation of the medullary substance in the sheath, the nervous tissue of the invertebrate *Metazoa* agrees precisely, so far as the minute structure is concerned, with that of vertebrates. The lowest forms in which nervous structures have been found are the *Medusæ*.

VEGETABLE HISTOLOGY.—By Vegetable Histology is meant the study by means of the microscope of the texture, web, or tissue of which plants are composed. It may be considered as synonymous with the minute anatomy of plants.

Nature of the Vegetable Cell.—If a small portion of the contents of the fertilized embryo-sac of the *Phaseolus multiflorus* (scarlet-runner, or French bean) be examined in a drop of water on a slide, it is seen to consist of protoplasm with a number of small free cells, in different stages of development, floating in it. These cells consist of little rounded masses of protoplasm with a single contour line; they have the protoplasm more or less granular; and each contains a rounded solid body, the nucleus, usually with a small spot, the nucleolus. Other cells in the preparation have a distinct wall with a double contour line, these being older and more fully developed. In examining the cells it is usually best not to employ pure water, but to use instead a solution of sugar or gum (1 part to 50 or 100 of water). Strasburger recommends, for examining the contents of the embryo-sac in phanerogams, a 3 per cent. solution of sugar, to which is added on the slide one drop of a 1 per cent. solution of osmic acid. Absolute alcohol may also be used for fixing the protoplasm in a nearly unaltered state. A longitudinal section of the growing end of the root of *Fritillaria imperialis* will exhibit the different stages of development of tissue cells. Near the apex the cells are more or less hexagonal in shape, and have a marked wall with a more or less distinct double contour. Inside the cell-wall, and in close contact with it, is the protoplasm, a densely granular, soft, inelastic mass, consisting of a mixture of albuminoids, and having in the center a round and relatively very large solid nucleus, with one or two nucleoli. In both *Phaseolus* and *Fritillaria*, as the cell enlarges, clear spaces, called vacuoles, but filled with cell-sap, that is, water with substance in solution, appear in the protoplasm of the cell. In some algæ contractile vacuoles are met with. The ordinary vacuoles rapidly increase in number and enlarge, separating the protoplasm into two parts—one in close contact with the wall of the cell, the other forming strings of varying size and thickness separating the vacuoles. Presently the vacuoles all coalesce and form a central cell-sap cavity, the protoplasm forming a completely closed sac inside the cell-wall. The nucleus remains embedded in the protoplasm, and is pushed to one side, appearing as if in contact with the wall. The vacuolated condition of the protoplasm may be considered as representing the cell at its state of greatest activity; the central cell-sap cavity is usually seen in tissue-cells, as in *Fritillaria*, and may be taken to indicate a condition of diminished activity. Further changes take place in tissue cells. The protoplasm with its nucleus may disappear and the cell-sap remain, or even the cell-sap itself may disappear sooner or later, and the dry cell-walls, as those of cork, be left. The conditions here described in *Fritillaria* may be taken as typical of all young tissue cells.

The protoplasm is the essential part of the cell, and by it all the other parts are formed, as well as all the substances, such as chlorophyll and starch, that are con-

ained in cells. When the cell contains protoplasm it can grow, multiply, and elaborate new chemical compounds; when the protoplasm disappears it ceases to perform any of these functions, and passively acts as a protection to deeper cells, or permits certain physical processes to take place, as the transport of water through the walls. The substance of the protoplasm seems to consist of a mixture of various albuminoids, and probably of other nitrogenous compounds. It is a more or less granular, soft, inelastic substance, never a true fluid, but varying in consistence in accordance with the quantity of water it contains.

Protoplasm is usually separable into two parts, an inner portion, endoplasm, more or less granular, and an outer more dense layer, the ectoplasm or primordial utricle, which is quite free from granules. A similar layer surrounds the protoplasm of the nucleus.

The living protoplasm exhibits movements either when inside a cell-wall or when the protoplasm is free and in the condition of a wall-less or primordial cell. The constant changes in protoplasm must be always accompanied by movement, but these are usually too small to be visible, and it is only in a few cases that the amplitude of the movements renders them visible. The movements are of four kinds, and are distinguished as rotation, circulation, amœboid, and ciliary.

The cell-wall is a thin, elastic, transparent and colorless membrane, destitute of visible openings (except in some cells of *Sphagnum* and in bordered pits), but easily permeated by water and gas. The walls of young cells consist almost exclusively of pure cellulose sulphuric acid and by ammoniacal solution of cupric oxide.

Mineral matters are often deposited in cell-walls. Calcium carbonate occurs rarely, calcium oxalate frequently, and silica is the commonest of all. Calcium carbonate forms the cystolithes of *Ficus* and of the *Acanthaceæ*, crystals or masses of crystals imbedded in the cell-wall but projecting into the cavity although surrounded by the substance of the wall. In corallines and many algæ, as also in the *Charas*, carbonate of lime is abundant in the cell-walls. Calcium oxalate crystals occur in the cell-walls of many plants, in other cases forming small granules. The crystals of calcium carbonate are soluble in acetic acid, while those of oxalate are not, although soluble in dilute nitric and hydrochloric acids. Silica is abundant in the *Diatomaceæ* and also in the cells of many of the higher plants, (*Equisetum*, grasses, beech, etc.)

Products of desorganization or degradation of the cell-wall occur in the form of gum, gum-resins, or resins, examples of which may be seen in the cherry, gum-arabic, gum-tragacanth, myrrh, etc. Gum-arabic consists of arabin, gum-tragacanth of bassorin, and cherry-gum is a mixture of the two. These substances, when formed, are apparently of no further use to the plant, and are produced by the destruction or desorganization of the cell-walls, as portions of the cell-wall can be distinctly traced when gum-tragacanth is examined microscopically.

Certain substances are formed by the protoplasm and separate from it in the form of granules or crystal-like bodies. The most important of these substances are chlorophyll and starch, the less important are aleurone grains and crystalloids.

The cell-sap consists of water with different substances in solution, the substances varying in different cells, and also changing in the same cell from time to time during growth. It saturates the whole wall and protoplasm, and collects in the vacuoles and cell-sap cavity.

Cytogenesis.—The enlargement of organs of plants is not only accompanied by an increase in the size of the individual cells, but new cells are also formed in the

part, these new cells, which are at first small, soon enlarging to their full dimensions. Usually the formation of a new cell takes place by the division of the protoplasm of a preëxisting cell, the mother-cell, into two portions of equal or unequal size, the daughter-cells. These daughter-cells in turn enlarge, and may each become the mother-cells of new daughter-cells. In this way by cell-division the vegetative cells of plants are increased in number. The process of reproduction in plants is invariably associated with the formation of a new cell or cells, and in general the process is very different from that of division, there being often a diminution in the number of cells, instead of an increase.

Union of Cells to Form Tissues.—Cells are usually united together to form an aggregate governed by some common law of growth. Such an aggregate of cells is called a tissue. Tissues are formed in different ways, and in accordance with their mode of formation are distinguished as true and false. A true tissue is formed by cell division. In this way the tissues of the higher plant are formed either originally from a single cell (apical cell) at the apex of the part, or from several cells (initial cells) situated at the growing point. In some of the lower plants false tissues are formed, rarely in some of the higher ones. The first mode of formation of a false tissue is noticed in some of the algæ, as in *Pediastrum* and in *Hydrodictyon*, as well as in the formation of the endosperm in the embryo sac of many plants, as in *Phaseolus*, *Gnetum*, etc. Here the cells are at first separate and distinct, but these loose cells become aggregated together, often, as in *Pediastrum* and *Hydrodictyon*, to form a beautiful and regular figure. In such instances the wall separating two cavities is a double structure formed by the union of two distinct walls. In the endosperm of the higher plants, when the false tissue is formed, the cells divide in the ordinary way, and at length give rise to a true tissue, as different modes of cytogenesis may occur in the same plant, either in different parts or at different times. The second mode of formation of a false tissue is seen in the fungi and lichens, in the peculiar hyphæ tissue so characteristic of these plants. The cells form long narrow rows or filaments, which branch and interlace, producing a network of interlacing fibers, but without the walls becoming fused firmly together as in *Pediastrum*. In some cases the hyphæ cells swell up and come into such close contact by mutual pressure that they form a tissue so like ordinary cell-tissue that it has been denominated pseudo-parenchyma. This variety of tissue occurs commonly in the higher fungi, as in the mushroom,

Walls of Tissue-Cells.—The cell-wall separating the contiguous cavities of two young cells appears as a simple homogeneous plate or lamella of pure cellulose. As the tissue grows older and the wall thickens, it apparently separates into distinct layers having different chemical and physical properties, so that in some cases it appears as if each cavity had its own special wall separated from the neighboring wall by a thin or thick layer of material, to which the older botanists gave the name of intercellular substance. The thickening layers usually exhibit a well-marked stratification, the strata often differing in chemical composition, as in pine-wood, in the bast of laburnum, or in the epidermis of *Viscum*, *Ephedra*, *Nerium Oleander*, etc.

HISTORY, in the most correct use of the word, means the prose narrative of past events, as probably true as the fallibility of human testimony will allow.

In practice, the line between history and mythus is often not easy to draw; but the theoretical distinction is plain. History reposes, however remotely, on contemporary witness to the fact related. Written records

are not absolutely indispensable, as tradition *may* supply their place and represent authentic contemporary testimony. But tradition is very insecure and apt to be equally inventive and oblivious. It is in the half light of tradition that mythus is born of the creative fancy of man, and the difficulty of separating fact from fiction in this border-land of mingled fable and reality very often amounts to impossibility.

The field of history is in consequence very limited, both in time and space, in proportion to the length of human existence and the area of the earth's surface occupied by man. Primitive and savage man has no history, because the struggle for existence consumes all his energies, and he has neither time nor faculty to think of himself as a social being, much less to make record of social events. But even when partially civilized, mankind is often incapable, not only of writing history, but of furnishing the materials of it. Under a system of caste, or conservative theocracy, or oppressive tradition as in India, Egypt, and China respectively, the social evolution is so slow that it hardly seems to move at all. The grandson lives among conditions hardly differing from those of the grandfather. In such a state of things the very subject-matter of history is wanting. Nothing attracts less notice than immobility, and large populations have often lived under conditions which for whole generations did not seem to vary. The vast and vacant annals of the East show that the arts of peace and war may attain considerable development without history or its materials being produced in consequence.

If these views be correct we can only allow a period of about 4,000 years as the limit of genuine history in point of time. The beginning would be with the historical books of the Old Testament. Before the Jewish records fail us the Greek have begun. The Romans follow in immediate succession, and the historical thread has never been broken since, though thicker and stronger in some epochs than in others. As regards area, history long dwelt exclusively on the shores of that inland sea which, if not the birthplace of the human race, have at least been the chief training-ground of its early youth and vigorous manhood. Civilization subsequently spread from the Mediterranean to remote islands and continents unknown to the ancients, and history has followed it. No doubt in time both will be coëxtensive with the globe; but that time has not yet come. It is still useful to remember that the materials of history now rapidly accumulating in the far West, the far South, and even the far East, owe their origin to that antiquity of which we are the heirs, to the civilization which took its rise in those ever-memorable centers named Rome, Athens and Jerusalem.

Early history is never critical and painstaking in the investigation of facts. Neither the historian nor his readers or hearers have reached a stage of culture in which accuracy is highly valued. Early history is essentially artistic, its object is much more to charm the fancy and warm the emotions than to instruct the understanding. A good story, pathetic or humorous, is appreciated for its own sake independently of its truth. Striking pictures, dramatic situations, often told in dialogue, scenes in which virtue and vice are depicted on a colossal scale—these are the chief objects of the early historical writer, who mingles fact and fiction with the same naiveté as his brethren, the writers of the early epos and drama.

History is of two kinds,—the old or artistic type of history, and the new or sociological type. The artistic type, invented by the Greeks, remained the ideal of history till comparatively recent times. Its aim was perfection of literary form, weight and dignity of language, depth of moral and sagacity of political reflection.

The new history is to a great extent characterized by opposite qualities. Its preoccupation about literary form is secondary, moral reflection it rather avoids, but it is laborious beyond precedent in research, and above all it is pregnant with the notion that society is a great aggregate of forces moving according to laws special to it, and similar to those producing evolution and growth analogous to what we see in other forms of life. The remainder of this article could not perhaps be better employed than by a short examination of these two types of history, including some reference to the causes which brought about a transition from one to the other.

A history of history is a desideratum in literature. The merit of such a work, if properly done, would consist, not only in the criticism of particular authors, but in a comparison of their epochs and social surroundings, and a pointing out how these influenced the character and quality of their historical writing. It is, for instance, worthy of notice that history is far more sensitive and dependent on public freedom than either poetry, science, philosophy, or jurisprudence. All these have flourished under governments more or less despotic, but history never. Tacitus seems to have felt this in the depth of his heart when he said that he was able to write as he did because of the "*rara temporum felicitas ubi sentire quæ velis et quæ sentias dicere licet.*" (That "rare happy time when you think as you will, and when thought gives license to speak.") Again, certain epochs are favorable to great historians, as periods of war are favorable to great soldiers. Rating the genius of the Greek historians as high as we please, and it is difficult to rate it too high, it is still manifest that they enjoyed exceptional advantages.

Continuing this vein of reflection, we might remark that it is a noteworthy fact that in history alone the Romans came nearest to their Greek models. Copyists in everything else, and inferior copyists, in history they equaled if they did not excel their masters. The Middle Ages would offer the historian of history ample scope for connecting the quality of historical writing with the social surroundings of the authors. The great monastic houses, such as Malmesbury, St. Albans, Eu, and many more, would be shown to have been such schools of history as they were, for very efficient reasons. The appearance of the modern Herodotus, Froissart, would seem meant expressly to show the union of opportunity and genius needed to produce great historical work. The dramatic struggle between feudalism and monarchy in the fifteenth century found a competent if somewhat rustic Tacitus in Comines, more friendly but on the whole not less severe to his bourgeois Tiberius, Louis XI. In the stirring times of the sixteenth century historians abound—Italians, Frenchmen, Lutchmen—too numerous to mention and too distinguished to be passed over with perfunctory notice here. And then occurs a really surprising phenomenon. History disappears from the continent of Europe for a century and a half. Between the Thirty Years' War and the Seven Years' War the Continent produced no historians whom the world cares to remember. History was indeed being written in France, the most witty, profound, and graphic since the days of Tacitus; but it was history which the author kept for himself and a remote posterity; not for a hundred years was the world to be permitted to gaze with wonder and admiration on the incomparable memoirs of St. Simon. But rebellious and revolutionary England gives us Clarendon and Burnet.

The old type of history, one might say, was a species of portrait painting which had often every merit except that of close likeness to the original. But it cannot be

denied that the old writers generally thought more of the brilliancy of their colors and the effectiveness of their pictures than of their exact truth. The old masters of history resembled, it is to be feared (if so honorable a comparison can be considered derogatory), the old masters of painting. Both thought little of what we call "local color," of close conformity to the scene or object delineated, provided they produced striking compositions with grand outline and rich tints which were attractive and beautiful for their own sake. When to this conception of their art we add their general apathy in research, the measure of their sins appears to be filled up in the eyes of a generation like ours, which has brought historical evidence under conditions nearly as stringent as those which regulate the depositions of a court of justice. Still it may occur to some persons that there is another side to this matter, and that the great men of old are not wholly without defense. They were indolent in research no doubt, or rather they did not attach the value that we do to it (if they had, they were not men to have spared their pains), but they were large, sympathetic, and humane. They wrote for a public composed of men of the world and not of specialists. Their manner is somewhat off-hand, but they are neither prigs nor pedants. It may be said generally, exceptions of course excepted, that the old historians were strong where their successors are weak, and the converse. Aiming chiefly at portraiture, they succeeded in it, as was only natural. Amid a crowd of errors on smaller matters, they often catch the true expression of a physiognomy, and hit off the salient points of a character with an insight and success which subsequent inquiry is often unable to modify.

The inferior quality of history in the seventeenth century and the first half of the eighteenth is the more remarkable from the contrast presented by the brilliancy of contemporary literature in other departments. Written by inferior men from a low point of view, or no point of view at all, history at last sank to such a degree in the public esteem as to be spoken of in a tone of contempt. Doctor Johnson openly despised it, and D'Alembert did nearly the same. And yet the time produced great antiquaries—Madox and Rymer in England, D'Achery and Mabillon in France, Maratori in Italy, Leibnitz in Germany. But history had no stamina or muscle.

When eighteenth-century writers are arraigned for their defective appreciation of the Middle Ages (the great stumbling-block) and remote periods generally, their critics forget the historical positions of the men they criticise. To write history in the eighteenth century was something very different from what it had been before, and this in several ways. First of all, the mere lengthening of the historic retrospect had enormously increased the field of historical survey. A writer of the eighteenth century looked back on nearly as much as we do; he had behind him the recent modern period, the long Middle Age, the barbarian epoch, those of Greece and Rome. And it was honorable to the men of the eighteenth century that they did not shrink from the task of writing on this immense expanse of history, imperfectly as they were prepared for it. Contemporaneous history may bring out some of the highest qualities of an historian—perspicacity, weightiness of judgment and language, skill in narrative, and so forth. But one quality it does not need and cannot display, insight into a remote age differing in culture, politics, and religion from those amid which the historian lives. Yet it was precisely the history of remote ages which the writers of the eighteenth century boldly undertook to treat. That they often failed is not surprising. It would have been a miracle if they had succeeded.

The unworthy interpretation of all political and religious phenomena with which the writers were unfamiliar, by sagacious references to state and priestcraft, is also apt at times to appear to us willfully perverse, and even disingenuous. We may be sure it was nothing of the kind, and only resulted from the inadequate degree of culture then attained.

But the historians in question were hindered not only by prejudice, which they could not avoid, from understanding the past; they were also hindered by a want of knowledge which it was impossible for them to have. When we see a man gravely ascribing the decline of old Rome to the fact that all the gold and silver after the division of the empire were carried to Constantinople, we realize the value of true conceptions relative to the wealth of nations. But in Montesquieu's time the precious metals were regarded as the sole or chief sources of wealth, and he applied without hesitation to history a principle which he saw statesmen apply without hesitation to politics.

But a change was near—a change in feeling and a change in knowledge. That singular modulation of key in the moral life of Europe, often called, for want of a better term, the Romantic movement, which arrested and surprised the attention of the latter half of the eighteenth century, was felt in relation to history as well as to philosophy, politics, and religion. The tastes and the tempers of men changed with a strange rapidity. The eighteenth-century philosophy, as it is called, lately so high and apparently secure, was cast out with contumely. The recent idols—Locke, Hume, Voltaire, Diderot—were smitten down, and others needless to name were put in their place. The whole movement is now seen to have been retrograde, and finally abortive, though temporarily successful. But it had its *raison d'être* and even its uses, as all social phenomena have. Among its uses was the service it rendered to history. Where men had only recently seen barbarism, superstition, and ignorance, they and their sons saw an enchanted land of beauty, piety, and grace. Then came Sir Walter Scott, who turned a current already flowing fast into a headlong torrent. The Middle Age was studied eagerly, sympathetically, perhaps a little too much so; zeal never is according to knowledge. But the bringing of the Middle Age into the circle of serious historic study had an influence beyond its immediate object. When men had brought themselves to study and understand eleventh-century popes and emperors, monasticism, feudalism, scholasticism, they became bold and capable of further adventures in historical enterprise. After the heroic ages of Christendom, the heroic ages of Greece were opened to explorers. And soon all exclusiveness disappeared. The whole past history of man was felt to be worthy of man's study—a wide field into which many laborers entered. So much for the change in feeling.

No less a change had taken place in the condition of knowledge. Speculation had for a long time been feeling its way to a closer contact with the problems suggested by the growing wealth and industry of the modern world. Adam Smith in his memorable work resumed, coördinated, and enlarged the labors of his numerous predecessors, and placed the study of economics on a new and positive basis. That book was in truth a lofty historical review of the facts of the past, guided by the principles of economic science.

Both the moral and the intellectual tendencies at work to produce a new temper with regard to history received an incalculable impetus from the French Revolution. That cataclysm revealed the deeper forces of society which had lain silent and unsuspected under the deceitful calm of the *ancien régime* in its latter days. It was

very certainly a revelation, though light came from the flames of Tophet, in Mr. Carlyle's phrase. Men saw the depth of the abyss over which they had lived in quiet ignorance, and their notions on man, society, and history underwent a great change. Passions undreamed of were let loose, and the passions of the present threw light on those of the past. History was read with new eyes. With the peace of 1815 historical studies acquired an activity and scope they never had before. All history, it was perceived, needed rewriting from new points of view, with more knowledge, deeper insight, keener sympathy. The French led the van of the new movement with their usual brilliancy and mastery of literary form. But it was their position as the nearest witness and the greatest sufferers and gainers by the Revolution which did most to open their eyes. A truly illustrious band of scholars and writers under the Restoration, the Monarchy of July, raised history into a position of honor it had never enjoyed before. The Germans, with their solid erudition, were not slow in following the French. Between the two, the Middle Ages, Greek and Roman antiquity, and the history of the Christian Church were studied with a minuteness and breadth never known before. History had entered on its modern phase.

Ancient history, chiefly in consequence of the extraordinary zeal and diligence of the Germans in what they call the science of antiquity (*Alterthumswissenschaft*), has become a reality, vivid in interest, and fruitful in knowledge, instead of the nebulous unreality it had been before. The rejection of the fabulous elements in the histories of Greece and Rome was the first step, but a long one, which it required many years and much effort to make. The next was to obtain a firm grasp of the idea that the Greeks and Romans were living men, and not statues like the Elgin Marbles, and to look at their politics, institutions and religions with the discriminating eye of common sense, and a real wish to see them as they were. The true nature of Athenian democracy, of the Spartan oligarchy, of the commons and patricians of Rome, of the party struggles which caused and justified the transition from the republic to the empire, has been put in a clear light, which can hardly be appreciated by those who are not aware of the darkness which it replaced. Points of view and lines of inquiry concerning the religion, government, institutions, taxation, and law of the ancient states have been opened up, of which the possibility in the old days was not suspected. The sociological knowledge of the present has illumined the past.

The history of the Middle Ages shows even greater results, and greater innovation. The great difficulty was the papacy. Between the Catholics, who regarded it as of divine institution, and the Protestants, who regarded it as a manifestation of Antichrist, and the sceptics, who despised both, and regarded it as mere superstition, this great center around which the life of the Middle Ages revolved had been unknown or misknown to a degree of absurdity. Gradually, as the nineteenth century arose wiser and sadder out of the chaos of the French Revolution, the immense part played by the church was at first dimly suspected, and at last with increasing clearness perceived. This must on every account be regarded as the greatest achievement of the modern school; it implied the unlearning of so many old errors, the acquiring of so many new truths, above all, the repression of so many deeply-rooted prejudices. It restored the continuity of history, in which the Middle Ages had hitherto appeared as an unexplained gap—an unwelcome wedge of barbarism thrust between the ancient and modern civilizations.

After the Middle Ages, the period which has been most illumined by the new lamp of history is that of the

early church, and the whole subject of religious dogma and institutions. In spite of the fierce controversies which have raged over this region, a large residuum of undisputed fact has been rescued from ignorance and prejudice, and church history is no longer a legend, but one of the most interesting chapters in the annals of the human mind.

As regards modern history, we are oppressed and nearly overwhelmed with the mass of new materials, and new discoveries which have been launched upon us. The diligent publication of state papers and documents, which all civilized states have taken in hand, has exceeded in the last half century all that had been done before in that direction. The result is that there are few periods of modern history which are not far better known to us than they were to the contemporaries who lived in them. But history in this field cannot boast of such laurels as she has won in the field of antiquity and the Middle Ages. There has been no great reversal of old points of view, no great triumph of historical perspicacity piercing through traditional error down to latent truth. Modern history has won its victories more by weight of metal than by the skill of its commanders, not that the generals have lacked skill, but they have had less occasion to display it.

The history of institutions has received much attention in recent times, and promises to be one of the most fruitful veins of inquiry yet opened, and this in reference both to primitive institutions, which are rather prehistorical, than historical, and the constitutions of states which have reached adult political life. The old Aryan tenure of land and village communities, and ancient law, whether in old Rome or modern Bengal, have been the subjects of elaborate investigation, embodied in works which mark a new departure in knowledge. The institutional history of political states is at the present moment perhaps the subject which attracts the most lively attention of scholars. It is not confined to the constitutional history of England, though England, as the mother of parliaments, has a fair claim to priority of interest. But the subject is narrowed and degraded by contemplating it from the point of view of modern politics, and chiefly in reference to the popular freedom or national wellbeing produced. The earnest historical inquirer is as impartial as the pathologist who studies disease equally with health. The institutions of despotism have their *raison d'être* and normal evolution as well as those of free governments, and the scientific historian will neglect the one as little as the other. In any case the history of the institutions of Europe from the times of the Frankish empire to the end of the French monarchy offers the widest field for courageous historical research. It has absorbed and transcended all those inquiries which used to be included under the somewhat jejune title of the history of civilization. Institutions in the secular order, and religions in the spiritual order, are now seen to be the most massive and permanent factors in human life, capable indeed of evolution and change, but little susceptible to the immediate action of man's intelligence and will, and yielding only to the new modifications brought about by time and the gradual transformation of ideas and moral conceptions, the result of increased knowledge.

It is hardly necessary to add that a broad distinction must be made between history and what has been called the philosophy of history, a term now replaced by the far better one "sociology," invented by A. Comte. Sociology has the purely scientific aim of investigating the nature and constitutions of societies, to discover the laws which regulate their growth and decay, to do in short for them what biology has already done for the animal and vegetable kingdoms. History, while it can

never again dispense with the assistance of sociology, remains occupied with the description of the social organism (at a given period) in its *ensemble*, and the term "descriptive sociology" has been suggested as an improvement on the old one, history. We may question whether the innovation will be accepted or is needed. The human interest attached to the story of man's past fortunes will always provoke the means of its own satisfaction, and there is little doubt that history, the name and the thing, as the highest form of prose literature, will continue to instruct and console mankind to the remotest generations.

HIT, the ancient *Is*, a town of Asiatic Turkey, vilayet of Baghdad, is situated on the west bank of the Euphrates, seventy miles west-northwest of Baghdad.

HITCHCOCK, EDWARD, an American geologist, was born of poor parents at Deerfield, Mass., May 24, 1793. In geology his most important achievement was the examination and exposition of the fossil footprints of the Connecticut valley. The collection which he accumulated in connection with his investigations is contained in the Hitchcock Ichnological Museum of Amherst College, and a description of it was published in 1858 in his report to the Massachusetts legislature on the ichnology of New England. As a writer on geological science, Hitchcock was mainly concerned in determining the connection between it and religion, and employing its results to explain and support what he regarded as the truths of revelation. He died at Amherst, February 27, 1864.

HITCHIN, a market-town of Hertfordshire, England, is situated on the small river Hiz, thirty-four miles from London, on the Great Northern Railway.

HITTITES, a warlike and powerful nation, whose center lay in the far north of Syria, between the Orontes and the Euphrates, but whose outposts about 1200 B.C. extended as far to the west as the Ægean sea. In the Egyptian inscriptions they are called the Khita or Kheta; in the Assyrian, the Khatti; in the Hebrew Scriptures, the Khittim. Some confusion has been caused in the treatment of the history of the Hittites by the uncritical use of the Old Testament.

HITTORFF, JACQUES IGNACE, French architect, was born at Cologne, August 20, 1793. Succeeding Bélanger as Government architect in 1818, he designed many important public and private buildings in Paris and also in the south of France. One of his important discoveries was that color had been made use of in ancient Greek architecture. He died at Paris, March 25, 1867.

HITZIG, FERDINAND, exegete and Biblical critic, was born at Hauingen, Baden, where his father was an evangelical pastor, on June 23, 1807; received his early education at the pädagogium of Lörrach and at the lyceum of Carlsruhe, and entered the university of Heidelberg as a student of theology in the autumn of 1824. As a Hebrew philologist he holds very high rank, and as a constructive critic he is remarkable for the acuteness and sagacity shown in his combinations. His theories, however, are often carried out with a vigor and rigor quite unwarranted by the amount of evidence upon which they rest, and his deficiency as a commentator in ideality and religious sympathy sometimes almost approaches the ludicrous.

HOACTZIN, or **HOATZIN**, a bird of tropical South America, thought by Buffon to be that indicated by Hernandez or Fernandez under these names, the *Opisthocomus hoazin* or *O. cristatus* of modern ornithologists—a very curious and remarkable form, which has long exercised the ingenuity of classifiers.

The Hoactzin appears to be about the size of a small pheasant, but is really a much smaller bird. The beak

is strong, curiously denticulated along the margin of the maxilla near the base, and is beset by diverging bristles. The eyes, placed in the middle of a patch of bare skin, are furnished with bristly lashes, resembling those of hornbills and some few other birds. The head bears a long pendent crest of loose yellowish feathers. The body is olive-colored, varied with white above, and beneath is of a dull bay. The wings are short and rounded. The tail is long, and tipped with yellow. The legs are long, the feet stout, the tarsi reticulated, and the toes scutellated; the claws long and slightly curved. According to all who have observed the habits of this bird, it lives in bands on the lower trees and bushes bordering the streams and lagoons, feeding on leaves and various wild fruits. It exhales a very strong odor—wherefore it is known in British Guiana as the "Stink-bird."

HOADLY, BENJAMIN, bishop of Winchester, was the second son of the Rev. Samuel Hoadly, and was born at Westerham, Kent, November 14, 1676. His first appearance as a controversialist was against Mr. Calamy in reference to conformity, and immediately after this he engaged in a more important dispute with Bishop Atterbury against the Anglican doctrine of nonresistance. His principal treatises on this subject were the *Measures of Submission to the Civil Magistrate* and *The Origin and Institution of Civil Government Discussed*. He died at his palace at Chelsea, April 17, 1761.

HOARE, SIR RICHARD COBB, Bart., English antiquary, eldest son of Sir Richard Hoare, the first baronet, an eminent banker, was born December 9, 1758. Hoare died at Stourhead, May 19, 1838.

HOBART TOWN, sometimes wrongly **HOBARTOWN** or **HOBARTON**, the capital of Tasmania (named by its founder, Colonel Collins, February 19, 1804, in honor of Lord Hobart, then secretary of state for the colonies), is situated in the south of the island. It occupies a succession of hills along a sheltered bight on the western bank of the Derwent river, known as Sullivan's Cove, about seventeen miles from the ocean. The city proper, forming nearly a square, and laid out in wide streets intersecting at right angles, has an area of 1,270 acres, and contains about 10,000 houses, with a population estimated (1890) at 60,000.

HOBBEMA, MEYNDERT, the greatest landscape painter of the Dutch school after Ruysdael, lived at Amsterdam in the second half of the seventeenth century. His merit has been but recently recognized, whence the obscurity in which his life remains. Nothing is more disappointing than to find that in Hobbema's case chronology and signed pictures substantially contradict each other. According to the latter his practice lasted from 1650 to 1689; according to the former his birth occurred in 1638, his death as late as 1709.

The best of Hobbema's pictures are those of the years 1663 to 1667. Of the former several in the galleries of Brussels and St. Petersburg, and one in the Holford collection, are celebrated.

HOBBS, THOMAS, was born at Westport, in North Wilts, on Good Friday, April 5, 1588. He was educated at Oxford university, and spent the earlier years of his life as companion or tutor to a son of Lord Hardwick.

After several journeys abroad in the capacity of tutor to young noblemen Hobbes came home, in 1637, to a country seething with discontent. The reign of "Thorough" was collapsing, and the forces pent up since 1629 were soon to rend the fabric of the English state to pieces. In February Hampden's case began to be tried; in July broke out the Edinburgh riot over Laud's prayer-book; next year was formed the Solemn

League and Covenant; the year after the rebel Scots had the king at their mercy in the open field; and finally in the spring of 1640, with a new prospect of war, Charles had no resource left but once more, after eleven years of personal rule, to call a parliament. Such a rush of events was but too likely to overpower Hobbes' resolution to work up to social problems from abstract questions of body and space and motion, and there is clear evidence that he was soon distracted from the orderly execution of his philosophic plan. It can be proved that at this time he had written not only his *Human Nature* but also his *De Corpore Politico*, the two treatises, though published separately ten years later, having been composed as parts of one work. We are therefore to understand, first, that he wrote the earliest draft of his political theory some years before the outbreak of the Civil War, and, secondly, that this earliest draft was not written till, in accordance with his philosophical conception, he had established the grounds of polity in human nature.

When, in six months more, the Long Parliament succeeded to the Short, and set to work at once by sending Laud and Strafford to the Tower, Hobbes, who had become, or thought he had become, a marked man by the circulation of his treatise, instantly took fright and hastened away to Paris. He was now for the fourth and last time abroad, and did not see England again for eleven years.

Meanwhile Hobbes, however eager he might be to keep himself abreast of the general philosophical movement of the time, had his thoughts too full of the political theory which the rush of events in the last years had ripened within him, to be able to settle, even in Paris, to the orderly composition of his systematic works. Though connected in his own mind with his view of human nature, and of nature generally, the political theory, as he always declared, could stand by itself. Also, while he may have hoped at this time to be able to add much (though he never did add much) to the first popular sketch of his doctrine of Man, he might extend, but could hardly otherwise modify, the sketch he had there given of his carefully articulated theory of Body Politic. Possibly, indeed, before that sketch was written, early in 1640, he may, under pressure of the political excitement, have advanced no small way in the actual composition of the treatise *De Cive*, the third section of his projected system. In any case, it was upon this section, before the others, that he set to work as soon as he was fixed in Paris; and before the end of 1641 the book, as we know from the date of the dedication (November 1st), was finished.

The Civil War had broken out in the middle of 1642, and, after a period of varying fortunes on either side, the royalist cause began to decline from the time of the defeat of the marquis of Newcastle at Marston Moor, in the middle of 1644. Then commenced an exodus of the king's friends. The sight of these exiles, from whom he learned all the details of the fierce work that had been going on in England while he was quietly busy with his studies in Paris, made the political interest once more predominant in Hobbes, and before long the revived feeling issued in the formation of a new and important design. It first showed itself in the publication of the *De Cive*, of which the fame, but only the fame, had extended beyond the inner circle of friends and critics who had copies of the original impression. Hobbes now intrusted it, early in 1646, to his admirer, the Frenchman Sobière, by whom it was seen through the Elzevir press at Amsterdam in 1647 — having previously inserted a number of notes in reply to objections, and also a striking preface, in the course of which he explained its relation to the other parts of

the system not yet forthcoming, and the (political) occasion of its having been composed and being now published before them. So hopeless, meanwhile, was he growing of being able to return home that, later on in the year, he was on the point of leaving Paris to take up his abode in the south with a French friend, when he was induced to remain as mathematical instructor to the young prince of Wales, who had come over from Jersey about the month of July. Thus thrown more than ever into the company of the exiled royalists, it was then, if not earlier, that he conceived his new design of bringing all his powers of thought and expression to bear upon the production of an English book that should set forth his whole theory of civil government in relation to the stupendous political crisis resulting from the war. The *De Cive*, presently to be published, was written in Latin for the learned, and gave the political theory without its foundation in human nature. The unpublished treatise of 1640 contained all or nearly all that he had to tell concerning human nature, but was written before the terrible events of the last years had disclosed how men might still be urged by their anti-social passions back into the abyss of anarchy. There was need of an exposition at once comprehensive, incisive and popular. The State, it now seemed to Hobbes, might be regarded as a great artificial man or monster (*Leviathan*), composed of men, with a life that might be traced from its generation through human reason under pressure of human needs to its dissolution through civil strife proceeding from human passions. This, we may suppose, was the presiding conception from the first, but the design may have been variously modified in the three or four years of its execution. Before the end, in 1650-51, it is plain that he wrote in direct reference to the greatly changed aspect of affairs in England. The king being no more, and the royalist cause appearing to be hopelessly lost, he did not scruple, in closing the work with a general "Review and Conclusion," to raise the question of the subject's right to change allegiance when a former sovereign's power to protect was irrecoverably gone. Also he took advantage of the lax rule of the Commonwealth to indulge much more freely than he might have otherwise dared in rationalistic criticism of religious doctrines; while, amid the turmoil of sects, he could the more forcibly urge that the preservation of social order, when again firmly restored, must depend on the assumption by the civil power of the right to wield all sanctions, supernatural as well as natural, against the pretensions of any clergy, Catholic, Anglican or Presbyterian, to the exercise of an *imperium in imperio*. We know the *Leviathan* only as it finally emerged from Hobbes' pen. During the years of its composition he remained in or near Paris, at first in attendance on his royal pupil, with whom he became a great favorite. The engagement must in any case have come to an end in the year 1648, when the prince removed to Holland, but it was probably broken off earlier by an illness that overtook Hobbes in 1647 and disabled him for six months. On recovering from this illness, which nearly proved fatal, he resumed his literary task, and carried it steadily forward to completion by the year 1650, having also within the same time translated into English, with characteristic force of expression, his Latin treatise. Otherwise the only thing known (from one or two letters) of his life in those years is that from the year 1648 he had begun to think of returning home; he was then sixty, and might well be weary of exile.

Though Hobbes came back after his eleven years' absence, without having as yet publicly proved his title to rank with the natural philosophers of the age, he

was sufficiently conscious of what he had been able to achieve in *Leviathan*; and it was in no humble mood that he now, at the age of sixty-four, turned to complete the fundamental treatise of his philosophical system. Neither were those whom his masterpiece soon roused to enthusiasm, or those whom it moved to indignation, likely to be indifferent to anything he should now write, whether it lay near to or far from the region of practice. Taking up his abode in London on his return, and continuing to reside there for the sake of intellectual society, he worked so steadily upon the materials he had long had by him as to be printing the *De Corpore* in the year 1654. Circumstances, however, kept the book back till the following year, and meanwhile the readers of *Leviathan* had a different excitement. In 1654 a small treatise, *Of Liberty and Necessity*, issued from the press, claiming to be an answer to a discourse on the same subject by Bishop Bramhall of Londonderry, addressed by Hobbes to the marquis of Newcastle. It was really such, and had grown out of an oral discussion between Hobbes and Bramhall in the marquis' presence at Paris in 1646,—Bramhall, a strong Arminian, having afterward written down his views and sent them to Newcastle to be answered in this form by Hobbes, and Hobbes having duly replied, but not for publication, because he thought the subject a delicate one. Unpublished, accordingly, the piece remained; but it happened that Hobbes, in the interval between writing his own reply and receiving from the bishop in 1647 a rejoinder which he left unanswered, allowed a French acquaintance to have a private translation of his reply made by a young Englishman, who secretly took also a copy of the original for himself; and now it was this unnamed purloiner who, in 1654, when Hobbes had become famous and feared, gave it to the world of his own motion, with an extravagantly laudatory epistle to the reader in its front. Upon Hobbes himself the publication came as a surprise, but after his plain speaking in *Leviathan*, there was nothing in the piece that he need scruple to have made known, and he seems to have readily enough condoned the offender's act. On the other hand, Bramhall, supposing Hobbes privy to the publication, might well resent the manner of it, especially as no mention was made of his rejoinder. Accordingly, in 1655, he printed everything that had passed between them (under the title of *A Defense of the True Liberty of Human Actions from Antecedent or Extrinsic Necessity*), with loud complaint against the treatment he had received, and the promise added that, in default of others, he himself would stand forward to expose the deadly principles of *Leviathan*. About this time Hobbes had begun to be hard pressed by other foes, and, being never more sure of himself than upon the question of the will, he appears to have welcomed the opportunity thus given him of showing his strength. By 1656 he was ready with his *Questions concerning Liberty, Necessity, and Chance*, in which he replied with astonishing force to the bishop's rejoinder point by point, besides explaining the occasion and circumstances of the whole debate, and reproducing all the pieces from the beginning.

We must now turn back to trace the fortunes of Hobbes and his other doings in the last twenty years of his life. All these controversial writings on mathematics and physics represent but one-half of his activity after the age of seventy; though, as regards the other half, it is not possible, for a reason that will be seen, to say as definitely in what order the works belonging to the period were produced. From the time of the Restoration he acquired a new prominence in the public eye. No year had passed since the appearance of *Leviathan* without some indignant protest against

the influence which its trenchant doctrine was calculated to produce upon minds longing above everything for civil repose; but it was not until the old political order was set up again that "Hobbism" became a fashionable creed, which it was the duty of every lover of true morality and religion to denounce. Friends and foes alike were impressed by the king's behavior to the aged philosopher. Two or three days after Charles' arrival in London, Hobbes, who had come up to town from spending the previous winter in Derbyshire, drew in the street the notice of his former pupil, and was at once received into favor. The young king, if he had ever himself resented the apparent disloyalty of the "Conclusion" of *Leviathan*, had not retained the feeling long, and could well enough appreciate the principles of the great book when the application of them happened, as now, to be turned in his own favor. He had, besides, from of old a relish for Hobbes' lively wit, and did not like the old man the less because his presence at court scandalized the bishops or the prim virtue of Chancellor Hyde. He even went the length of bestowing on Hobbes (but not always paying) a yearly pension of £100, and had his portrait hung up in the royal closet. These marks of favor, naturally, did not lessen Hobbes' self-esteem, and perhaps they explain, in his later writings, a certain slavishness of feeling toward the regal authority, which is wholly absent from his rational demonstration of absolutism in the earlier works. At all events Hobbes remained very well satisfied with the rule of a king who had the sense to appreciate the author of *Leviathan*, and to protect him, when after a time protection in a very real sense became necessary. His eagerness to defend himself against Wallis' imputation of disloyalty, and his apologetic dedication of the *Problemata Physica* to the king, are evidences of the hostility with which he was being pressed as early as 1662; but it was not until 1666 that he felt himself seriously in danger. In that year the Great Fire of London, following in ominous succession on the Great Plague of the year before, roused the superstitious fears and intolerant passions of the people, and the House of Commons embodied the general feeling in a bill against atheism and profaneness. On October 17th it was ordered that the committee to which the bill was referred "should be empowered to receive information touching such books as tended to atheism, blasphemy, and profaneness, or against the essence and attributes of God, and in particular the book published in the name of one White, and the book of Mr. Hobbes called the *Leviathan*, and to report the matter with their opinion to the House." What steps were taken before January 31st following, when the bill was read a third time and passed, does not appear; but Hobbes, then verging upon eighty, was greatly terrified at the prospect of being treated as a heretic, and proceeded to burn such of his papers as he thought might compromise him. At the same time he set himself, with a very characteristic determination, to inquire into the actual state of the law of heresy. The results of his investigation were first announced in three short Dialogues added (in place of the old "Review and Conclusion," for which the day had passed) as an Appendix to his Latin translation of *Leviathan*, included with the general collection of his works published at Amsterdam in 1668. In this appendix, as also in the posthumous tract, published in 1680, *An Historical Narration Concerning Heresy and the Punishment thereof*, he aimed at showing that, since the High Court of Commission had been put down, there remained in England no court of heresy at all to which he was amenable, and that even when it stood nothing was to be declared heresy but what was at variance

with the Nicene Creed, as he maintained the doctrine of *Leviathan* was not.

The only consequence that came of the parliamentary scare was that Hobbes could never afterward get permission to print anything on subjects relating to human conduct. The collected edition of his Latin works (in two quarto volumes) appeared at Amsterdam in 1668, because he could not obtain the censor's license for its publication at London, Oxford, or Cambridge. Other writings which he had finished, or on which he must have been engaged about this time, were not made public till after his death—the king apparently having made it the price of his protection that no fresh provocation should be offered to the popular sentiment. The most important of the works composed toward 1670, and thus kept back, is the extremely spirited dialogue to which he gave the title *Behemoth: the History of the Causes of the Civil Wars of England and of the Counsels and Artifices by which they were carried on from the year 1640 to the year 1660*. To the same period probably belongs the unfinished *Dialogue between a Philosopher and a Student of the Common Laws of England*, a trenchant criticism of the constitutional theory of English government as upheld by Coke. Aubrey takes credit for having tried to induce Hobbes to write upon the subject in 1664 by presenting him with a copy of Bacon's *Elements of the Laws of England*, and though the attempt was then unsuccessful, Hobbes later on took to studying the statute-book, with *Coke upon Littleton*. One other posthumous production (besides the tract on Heresy before mentioned) may also be referred to this, if not, as Aubrey suggests, an earlier time—the two thousand and odd elegiac verses into which he amused himself by throwing his view of ecclesiastical encroachment on the civil power; the quaint verses, disposed in his now favorite dialogue-form, were first published, nine years after his death, under the title *Historia Ecclesiastica*, with a preface by Thomas Rymer.

For some time Hobbes was not even allowed to utter a word of protest, whatever might be the occasion that his enemies took to triumph over him. In 1669 he had silently to bear the spectacle of an unworthy follower—Daniel Scargil by name, a fellow of Corpus Christi at Cambridge—made to act an edifying part in a public recantation of his principles after having brought them into discredit by offensively supporting them in the public schools. A few years later, in 1674, he had another experience of academic disfavor when Dr. John Fell, the dean of Christ Church, who bore the charges of the Latin translation of Anthony Wood's *History and Antiquities of the Universities of Oxford* (1670), struck out all the complimentary epithets in the account of his life, and substituted very different ones; but this time the king did suffer him to defend himself by publishing a dignified letter, to which Fell replied by adding to the translation when it appeared a note full of the grossest insults. And, amid all his troubles, Hobbes was not without his consolations. No Englishman of that day stood in the same repute abroad, and foreigners, noble or learned, who came to England, never forgot to pay their respects to the old man, whose vigor and freshness of intellect no progress of the years seemed able to quench.

His pastimes in the latest years were as singular as his labors. The autobiography in Latin verse, with its playful humor, occasional pathos, and sublime self-complacency, was thrown off at the age of eighty-four. At eighty-five, in the year 1673, he sent forth a translation of four books of the *Odyssey* (ix.—xii.) in rugged but not seldom happily turned English rhymes; and, when he found this *Voyage of Ulysses* eagerly received, he had ready by 1675 a complete translation of both *Iliad* and *Odyssey*, prefaced by a lively dissertation "Con-

cerning the virtues of an heroic poem," showing his unabated interest in questions of literary style. In that year (1675) he ceased coming to London, and thenceforth passed his time at his patron's seats in Derbyshire, always occupied to the last with some intellectual work in the early morning and in the afternoon hours, which it had long been his habit to devote to thinking and to writing. With such tenacity did he cling to his pursuits (always systematically keeping up exercise for the sake of health) that even as late as August, 1679, he was promising his publishers "somewhat to print in English." The end came very soon afterward. A suppression of urine in October, in spite of which he insisted upon being conveyed with the family from Chatsworth to Hardwick Hall toward the end of November, was followed by a paralytic stroke, under which he sank on December 4th, in his ninety-second year. He lies buried in the neighboring parish church of Hault Hucknall.

HOBOKEN, a city and port of entry of New Jersey, is situated in Hudson county, on the west bank of the Hudson river, opposite the city of New York. Jersey City, with which the town is connected by lines of street cars, lies not far distant, and constant communication with New York city is kept up by means of steam ferry-boats. Several other neighboring towns also have lines of horse cars and other vehicles which afford easy and convenient transit to and from Hoboken. The most important branch of business carried on in the city is the coal trade, from which the shipping of the neighboring ports as well as the inhabitants of New York city draw their chief supply. Several lines of railway center here, giving the city overland connection with all sections of the continent, while ocean steamships ply between this point and various foreign and coastal ports. Some manufactures are carried on, and the commerce of the city is extensive and growing in importance. Its banking and telegraph facilities are good, while its contiguity with New York affords every convenience for the transaction of almost every kind of business. There are numerous churches, the principal denominations having vigorous organizations, and buildings furnishing sittings ample in their accommodations. In addition to the common school system there are several institutions for higher education, and an institute of technology, well equipped and sustained.

The municipal government consists of a mayor, clerk, treasurer, collector of revenue, corporation attorney, comptroller, water registrar, city physician, street commissioner, overseer of poor, assessor, and eight councilmen (two from each of the four wards of the city). The financial exhibit for the year 1889 is as follows: Bonded debt, \$1,131,850; total receipts, \$902,827; total expenditures, \$814,906.69, leaving a balance of \$87,920.41. Taxes apportioned for the present year (1890), \$402,275.47.

The school system is represented as follows: five school buildings, occupied by the grammar, ungraded, and one high school, with a school library of 1,200 volumes. School receipts for year, \$93,252.84; expenditures, \$92,260.99, giving tuition to an enrollment of 6,077 pupils out of a total school population of 13,452. The town has an efficient fire department, consisting of four steamer companies, three hose companies, two hook and ladder companies, together with their proper officers, and has in addition a good system of police and fire alarm telegraph. The police department consists of a chief, three aids, four roundsmen, two detectives, fifty patrolmen, and forty-six substitutes, and was maintained last year at a cost of \$57,789.93. The water supply of the city is excellent, and was maintained during this last fiscal year at a cost of

\$113,868.74, returning a revenue of \$114,072.07 (including appropriation for that department). The city is lighted by gas and electricity, and has a good system of charities, and an excellent hospital. Its population numbers (1890) 43,648.

HOCHE, LAZARE, a French general of the time of the Revolution, was born of poor parents at Montreuil near Versailles, June 25, 1768. Having risen to the rank of sergeant, he, at the outbreak of the Revolution, made an important stand with a mere handful of troops against a large body of insurgents; and it was he also who, at a later period, defended the entrance to the chamber of the queen when her apartments were invaded by a revolutionary mob. He distinguished himself at the siege of Thionville in 1792, and at the battle of Neerwinden, March 13, 1793. Shortly afterward he received the brevet of general of brigade, and was appointed to the command of Dunkirk, for his brilliant defense of which against the duke of York he received the chief command of the army of Moselle. Shortly afterward he was assigned the chief command by the representatives of the people with the two armies, but, this promotion awakening the morbid suspicion of Robespierre, he was recalled and thrown into prison, and it was only the timely fall of Robespierre that saved him from the guillotine. Afterward he was appointed to the command of an army organized for the conquest of Ireland. The expedition set sail from Brest, December 16, 1796, but was dispersed by a storm, scarcely one half of the vessels escaping shipwreck or capture. In the following year Hoche was sent to the eastern frontier to act against Austria, and by a series of masterly maneuvers he succeeded in surrounding the army of General Kray, and but for a declaration of peace would have taken him and all his troops prisoners of war. Not long after his return he was appointed to the command of the united army in Germany, but eight days afterward he died suddenly at Wetzlar, September 18, 1797.

HODGE, CHARLES, theologian, was born in Philadelphia, December 28, 1797. He was educated at the college of New Jersey in Princeton, where he graduated in 1815, and afterward at the theological seminary of the Presbyterian Church in the same place. From 1835 to 1868 he wrote yearly an article reviewing the action of each general assembly, which series has exerted a powerful influence over the current opinion and history of the church to which he belonged. The most part of these have been republished in Great Britain and in America, in volumes, under the titles of *Hodge's Essays*, *Princeton Theological Essays* and *Hodge's Church Polity*. He was made doctor of divinity by Rutgers College, N. J., in 1834, moderator of the general assembly (O.S.) in 1846, member of the committee to revise the *Book of Discipline* of the Presbyterian Church in 1858, and LL.D. by Washington College, Penn., in 1864. He continued to instruct his classes uninterruptedly up to the time of his death in Princeton, June 10, 1878.

HODGKINSON, EATON (1789-1861), a distinguished English engineer, was the son of a farmer, and was born at Anderton, near Northwich, Cheshire, February 26, 1789. In 1840 Hodgkinson communicated a paper to the Royal Society on *Experimental Researches on the Strength of Pillars of Cast-iron and other Materials*, in recognition of which he in 1841 received the royal medal, and was also elected a fellow. His formulæ for solid and hollow pillars soon obtained general adoption in all engineering class-books. Subsequently he was employed by Stephenson to verify the experiments of Fairbairn on wrought-iron tubes, with a view to the construction of the Britannia Bridge; and

for his coöperation in this work he received a silver medal at the Paris Exhibition of 1855. In 1847 he was appointed professor of the mechanical principles of engineering in University College, London. In 1848 he was chosen president of the Manchester Philosophical Society, of which he had been a member since 1826, and to which, both previously and subsequently, he contributed many of the more important results of his discoveries. For several years he took an active part in the discussions of the Institution of Civil Engineers, of which he was elected an honorary member in 1851. He died at Eaglesfield House, near Manchester, June 18, 1861.

HÓDMEZŐ-VÁSÁRHELY, a corporate town in the county of Csongrád, Hungary, is situated on the lake Hód, and on the Alföld Railway, about ninety miles southeast of Budapest. Population, 50,000.

HODOGRAPH is the name given to a geometrical construction which greatly facilitates the study of kinematical questions. It was invented by Sir William Rowan Hamilton about 1845, and the first account of it, written by him, is to be found in the *Proc. R. I. A.* for 1846.

The hodograph may be thus defined: If a point be in motion in any orbit and with any velocity, and if, at each instant, a line be drawn from a fixed point parallel and equal to the velocity of the moving point at that instant, the extremities of these lines will lie on a curve called the hodograph.

HODY, HUMPHREY, an English divine, was born at Odcombe in Somersetshire in 1659, and died in 1706.

HOF, originally **REGNITZHOF**, a town of Bavaria, circle of Upper Franconia, is beautifully situated on the Saale, on the northeastern spurs of the Fichtelgebirge, and at the junction of several railways, thirty miles north-northeast of Baireuth. Population, 20,000.

HOFER, ANDREAS, a Tyrolese patriot, was born October 2, 1767, at St. Leonhardt, in the Passeyr valley. On the outbreak of the war in 1796, he commanded a company of riflemen against the French at Lake Garda, and after the peace of Lunéville he took an active part in organizing the Tyrolese militia. After the treaty of Presbur (1805), by which Tyrol was transferred from Austria to Bavaria, Hofer was chosen a member of the secret Tyrolese deputation which went to Vienna to confer with the emperor on the condition of the country; and when, on the advice of Austria, the whole of Tyrol in April, 1809, rose in arms, Hofer was chosen to the command of a large division of the insurgents, and inflicted an overwhelming defeat on the Bavarians at Sterzing. Reënforcements sent by Napoleon defeated the Austrians at Woergl and the Tyrolese at Feuersinger, but Hofer coming to the rescue of his country repulsed the Bavarians with great loss at Innsbruck. Notwithstanding also that Austria after Napoleon's victory at Wagram agreed to evacuate Tyrol, Hofer resolved to maintain the struggle, and on August 13th, at Berg Isel, routed with great slaughter a combined French and Bavarian force, and completely freed his country from foreign dominion. For some time the internal affairs of Tyrol were administered by an independent government of which Hofer was the head, but after the peace of Vienna the Bavarians again began to assert their supremacy, and after a heroic resistance Hofer was compelled to flee for safety to the mountains. A price was set upon his head, and on account of the treachery of one of his most trusted followers, he was captured January 27, 1810, in a chalet in Passeyr valley. He was sent to Mantua for trial, and on February 20, by orders of Napoleon, was executed twenty-four hours after his condemnation.

HOFFMANN, AUGUST HEINRICH, known as Hoff-

mann von Fallersleben, German poet, philologist, and historian of literature, was born at Fallersleben, in Lüneburg, April 2, 1798. In 1823 he was appointed librarian to the university of Breslau, a post which he held till 1838. He was made extraordinary professor of the German language and literature at the university in 1830, and full professor in 1835; but he was deprived of his chair in 1842 in consequence of his *Unpolitische Lieder*, which gave much offense to the ruling classes of Prussia. In 1860 he became librarian to the duke of Ratibor, and he retained this appointment till his death on January 20, 1874.

HOFFMANN, ERNST THEODOR WILHELM, German romance writer (for whose name Wilhelm, his own substitute, in homage to Mozart, was Amadeus), was born at Königsberg, January 24, 1776. In 1798 he became referendary in the supreme court at Berlin, and in 1800 passed his final examination and was appointed assessor to the court of Posen; but, in 1804, he was transferred as councilor to Warsaw. He soon became the center of musical society in Warsaw, but in the spring of 1807 he returned to Berlin. The editor of the *Allgemeine Musikalische Zeitung* enlisted his services, and in that paper appeared a series, afterward published, with a preface by Jean Paul Richter, as *Fantasiestücke in Callots Manier* (1814; 4th ed., 1864). He composed at this time, among other things, a *Miserere*, by order of the grand-duke of Würzburg, and, for the proprietors of the Bamberg theater, music to Kotzebue's opera *Das Gespenst*; and he also gave lessons in music and drawing, decorated saloons, and painted portraits to order. The money which he inherited at the death of his uncle did not suffice to pay his debts; and he had been reduced to selling his last coat for food when his friends obtained for him the post of musical director to another theatrical company, performing alternately at Dresden and Leipsic. Hoffmann was writing romances in a garret in Dresden, or bedridden by gout, was drawing caricatures of the "verwünschte Franzosen" while Napoleon and the allied armies were struggling round its walls. In 1814 appeared his *Vision auf der Schlachtfelde von Dresden*; and in the same year, on the fall of Napoleon, he returned to Berlin and was reinstated in the legal profession. Two years later he was appointed councillor in the supreme court, and from that time enjoyed a good income, a dignified position and the society of his best friends. He was already, in virtue of his *Fantasiestücke*, regarded as one of the most notable romance writers of his day, but most of his works were yet to come. These followed each other in quick succession. *Die Elixiere des Teufels* appeared in 1816; *Nachtstücke* in 1817; *Seltene Leiden eines Theaterdirektors* in 1818; *Die Serapionsbrüder*, a collection of tales, in 1819-24; *Klein Zaches, genannt Zinnober*, in 1819; *Prinzessin Brambilla* in 1821; *Meister Floh* in 1822; and *Lebensansichten des Katers Murr* in 1821-22. He also composed the opera *Undine*, the libretto of which was prepared by Fouqué himself. It was performed with success in Berlin; but the music was lost in the subsequent destruction of the opera house by fire. He died at Berlin, July 24, 1822. *Der Feind*, his last work, remained unfinished.

HOFFMANN, FRIEDRICH, the most famous physician in a family that had been connected with medicine for 200 years before him, was born at Halle, February 19, 1660. At the age of eighteen he went to study medicine at Jena, whence in 1680 he passed to Erfurt. Next year, returning to Jena, he received his doctor's diploma, and, after publishing a thesis, was permitted to teach. Constant study then began to tell on his health, and in 1682, leaving his already numer-

ous pupils, he proceeded to Minden in Westphalia to recruit himself. After practicing his profession at Minden for two years, Hoffmann made a journey to Holland and England.

Toward the end of 1684 he returned to Minden, and during the next three years he received many flattering appointments. In 1688 he removed to the more promising sphere of Halberstadt, with the title of physician to the principality of Halberstadt; and on the founding of Halle university, in 1693, his reputation, which had been steadily increasing, procured for him the primarius chair of medicine, while at the same time he was charged with the responsible duty of framing the statutes for the new medical faculty. He filled also the chair of natural philosophy. With the exception of four years (1708-12), which he passed at Berlin in the capacity of royal physician, without, however, giving up his professorship, Hoffmann spent the rest of his life at Halle in instruction, practice, and study, interrupted now and again by visits to different courts of Germany, where his services procured him honors and rewards. He died at Halle, on November 12, 1742.

HOFFMANN, JOHANN JOSEPH, an eminent Chinese and Japanese scholar, was born at Würzburg on February 16, 1805. In 1875, in recognition of his profound scholarship, he was decorated with the order of the Netherlands Lion, and in 1877 he was elected corresponding member of the Berlin Academy. But these honors came almost too late; for a disease of the lungs from which he had long suffered terminated fatally on January 19, 1878.

HOFMANN, JOHANN CHRISTIAN KONRAD VON, Lutheran theologian, was born December 21, 1810, at Nuremberg. His death occurred on December 20, 1877.

HOGARTH, WILLIAM. Apart from the story of his works, the life of the greatest English pictorial satirist, when divested of doubtful tradition, is singularly devoid of incident. Hogarth was born in London, November 10, 1697.

"His first employment" (*i. e.*, after he set up for himself) "seems," says Nichols, "to have been the engraving of arms and shop bills." After this he was employed in designing "plates for booksellers." Of these early and mostly insignificant works we may pass over *The Lottery*, an Emblematic Print on the South Sea, and some book illustrations, to pause at *Masquerades and Operas*, 1724, the first plate he published on his own account. In 1726 he prepared twelve large engravings for Butler's *Hudibras*. These he himself valued highly, and they are the best of his book illustrations. But he was far too individual to be the patient interpreter of other men's thoughts, and it is not in this direction that his successes are to be sought.

On March 23, 1729, he was married at old Paddington church to Jane Thornhill. The match was a clandestine one, although Lady Thornhill appears to have favored it. We next hear of him in "lodgings at South Lambeth," where he rendered some assistance to the then well-known Jonathan Tyers, who opened Vauxhall in 1732, with an entertainment styled a *ridotto al fresco*. For these gardens Hogarth painted a poor picture of Henry VIII. and Anna Bullen, and for them he also made some designs of the *Four Times of the Day*, which he afterward elaborated into a finished series. The only engravings between 1726 and 1732, which need be referred to, are the *Large Masquerade Ticket* (1727), another satire on masquerades, and the print of *Burlington Gate*, 1731, evoked by Pope's *Epistle to Lord Burlington*, and defending Lord Chandos, who is therein satirized. This print gave great offense, and was, it is said, suppressed. To 1732 belongs that genial journey from London to Sheerness

of which the original record still survives at the British Museum.

In 1733 Hogarth moved into the "Golden Head" in Leicester Fields, which, with occasional absences at Chiswick, he continued to occupy until his death. By this date he must have completed the earliest of those great series of moral paintings which first gave him his position as a great and original genius. This was *A Harlot's Progress*, the paintings for which, if we may trust the date in the last of the pictures, were finished in 1731. The engravings, by the artist himself, were published in 1734.

The favorable reception given to *A Harlot's Progress* prompted *A Rake's Progress*, which speedily followed, although it had not a like success. It was in eight plates in lieu of six. The story is unequal; but there is nothing finer than the figure of the desperate rake in the Covent Garden gaming-house, or the admirable scenes in the Fleet prison and Bedlam, where at last his headlong career comes to its tragic termination. The plates abound with allusive suggestion and covert humor; but it is impossible to attempt any detailed description of them here.

A Rake's Progress was dated June 25, 1735, and the engravings bear the words "according to Act of Parliament." This was an act (8 Geo. II. cap. 13) which Hogarth had been instrumental in obtaining from the legislature, being stirred thereto by the shameless piracies of rival printsellers. Although loosely drawn, it served its purpose; and the painter commemorated his success by a long inscription on the plate entitled *Crowns, Miters, etc.*, afterward used as a subscription ticket to the Election series. These subscription tickets to his engravings, let us add, are among the brightest and most vivacious of the artist's productions. That to the *Harlot's Progress* was entitled *Boys Peeping at Nature*, while the *Rake's Progress* was heralded by the delightful etching known as *A Pleased Audience at a Play*, or *The Laughing Audience*.

We must pass more briefly over the prints which followed two *Progresses*, noting first *A Midnight Modern Conversation*, an admirable drinking scene which comes between them in 1734, and the bright little plate of *Southwark Fair*, which, though dated 1733, was published with *A Rake's Progress* in 1735. Between these and *Marriage à la Mode*, upon the pictures of which the painter must have been not long after at work, come the small prints of the *Consultation of Physicians*, *Scholars at a Lecture*, and *Sleeping Congregation*, 1736; the *Four Times of the Day*, 1738, a series of pictures of everyday eighteenth-century life; the *Strolling Actresses Dressing in a Barn*, 1738, and finally the admirable plates of the *Distrest Poet*, painfully composing a poem on "Riches" in a garret, and the *Enraged Musician* fulminating from his parlor window upon a discordant orchestra of knife-grinders, milk-girls, ballad-singers and the rest upon the pavement outside. These are dated respectively 1736 and 1741. To this period also (*i.e.*, the period preceding the production of the plates of *Marriage à la Mode*) belong two of those history pictures to which, in emulation of the Haymans and Thornhills, the artist was continually attracted. The *Pool of Bethesda* and the *Good Samaritan*, "with figures seven feet high," were painted *circa* 1736, and presented by the artist to St. Bartholomew's Hospital, where they remain. They were not masterpieces; and it is pleasanter to think of his connection with Captain Coram's recently established Foundling Hospital (1739), which he aided with his money, his graver and his brush, and for which he painted that admirable portrait of the good old philanthropist which is still, and deservedly, one of its chief ornaments.

The engravings of *Marriage à la Mode* were dated April, 1745. Although the painter by this time found a ready market for his engravings, he does not appear to have been equally successful in selling his pictures. The people bought his prints; but the more opulent and not numerous connoisseurs who purchased pictures were wholly in the hands of the importers and manufacturers of "old masters."

But, if Hogarth was not successful with his dramas on canvas, he occasionally shared with his contemporaries in the popularity of portrait painting. For a picture, executed in 1746, of Garrick as Richard III. he was paid £200, "which was more," says he, "than any English artist ever received for a single portrait." In the same year a sketch of Simon Fraser, Lord Lovat, afterward beheaded on Tower Hill, had an exceptional success. Our limits do not, however, enable us to refer to his remaining works in detail, and we must content ourselves with a brief enumeration of the most important. These are *The Stage Coach, or Country Inn Yard*, 1747; the series of twelve plates entitled *Industry and Idleness*, 1747, depicting the career of two London apprentices; the *Gate of Calais*, 1749, which had its origin in a rather unfortunate visit paid to France by the painter after the peace of Aix-la-Chapelle; the *March to Finchley*, 1750; *Beer Street*, *Gin Lane*, and the *Four Stages of Cruelty*, 1751; the admirable representations of election humors in the days of Sir Robert Walpole, entitled *Four Prints of an Election*, 1755-8; and the plate of *Credulity, Superstition, and Fanaticism, a Medley*, 1762, adapted from an earlier unpublished design called *Enthusiasm Delineated*. Besides these must be chronicled three more essays in the "great style of history painting," viz., *Paul before Felix*, *Moses brought to Pharaoh's Daughter*, and the *Altarpiece* for St. Mary Redcliff at Bristol. The first two were engraved in 1751-2, the last in 1794. A subscription ticket to the earlier pictures, entitled *Paul before Felix Burlesqued*, had a popularity far greater than that of the prints themselves.

In 1745 Hogarth painted that admirable portrait of himself with his pug-dog Trump, which is now in the National Gallery. In a corner of this he had drawn on a palette a serpentine line with the words "The Line of Beauty and Grace." Much inquiry ensued as to "the meaning of this hieroglyphic;" and in an unpropitious hour the painter resolved to explain this meaning in writing. The result was the well-known *Analysis of Beauty*; 1753, a treatise "to fix the fluctuating ideas of Taste," otherwise a desultory essay having for pretext the precept attributed to Michelangelo that a figure should be always "Pyramidall, Serpent-like, and multiplied by one two and three." In 1759 the success of a little picture called *The Lady's Last Stake*, painted for Lord Charlemont, procured him a commission from Sir Richard Grosvenor to paint another picture "upon the same terms." Unhappily on this occasion he deserted his own field of *genre* and social satire, to select the story from Boccaccio (or rather Dryden) of Sigismonda weeping over the heart of her murdered lover Guiscardo, being the subject of a picture by Furini in Sir Luke Schaub's collection which had recently been sold for £400. The picture, over which he spent much time and patience, was not regarded as a success.

In 1761 he was sixty-five years of age, and he had but three years more to live. These three years were embittered by that unhappy quarrel with Wilkes and Churchill, over which most of his biographers are contented to pass rapidly. Having succeeded John Thornhill in 1757 as serjeant painter (to which post he was reappointed at the accession of George III.) an evil genius prompted him in 1762 to do some "timed" thing

in the ministerial interest, and he accordingly published the indifferent satire of *The Times*, plate i. This at once brought him into collision with his quondam friends, John Wilkes and Churchill the poet; and the immediate result was a violent attack upon him, both as a man and an artist, in the opposition *North Briton*, No. 17. The alleged decay of his powers, the miscarriage of Sigismunda, the cobbled composition of the *Analysis*, were all discussed with scurrilous malignity by those who had known his domestic life and learned his weaknesses. The old artist was deeply wounded, and his health was failing. Early in the next year, however, he replied by that squinting portrait of Wilkes which will forever carry his features to posterity. Churchill retaliated in July by a savage *Epistle to William Hogarth*, to which the artist rejoined by a print of Churchill as a bear, in torn bands and ruffles, not the most successful of his works. "The pleasure and pecuniary advantage," writes Hogarth, "which I derived from these two engravings" (of Wilkes and Churchill), "together with occasional riding on horseback, restored me to as much health as can be expected at my time of life." He produced but one more print, that of *Finis*, or *The Bathos*, March, 1764, a strange jumble of "fag ends" intended as a tailpiece to his collected prints; and on October 26th of the same year he died of an aneurism at his house in Leicester Square. His wife, to whom he left his plates as a chief source of income, survived him until 1789.

HOGG, JAMES (1770–1835), a Scottish poet, best known by his title of the "Ettrick Shepherd," was born on the banks of the Ettrick in Selkirkshire in 1770. While attending to his flock, he spent a great deal of time in reading. His first printed piece was "The Mistakes of a Night," which appeared in the *Scots Magazine* for October, 1794, and was succeeded by *Scots Pastorals* in 1801. A year or two after this publication Hogg became acquainted with Sir Walter Scott—a connection which had a powerful influence for good on the peasant poet. He again appeared before the public in 1807 as the author of the *Mountain Bard*, to which Scott wrote an introductory notice. The appearance of the *Queen's Wake* in 1813 established Hogg's reputation as a poet; it was followed by *Mador of the Moor*, *The Pilgrims of the Sun*, and *The Poetic Mirror*. The duchess of Buccleuch, on her death-bed in 1814, had asked the duke to do something for the Ettrick bard; and the duke gave him a lease for life of the farm of Altrive in Yarrow, consisting of about seventy acres of moorland, on which the poet built a house and spent the last years of his life. He took possession of it in 1817; but his literary exertions were never relaxed. Before 1820 he had written *The Brownie of Bodsbeck*, and two volumes of *Winter Evening Tales*, besides collecting, editing, and writing part of two volumes of *Jacobite Relics*, and contributing largely to *Blackwood's Magazine*. With his pen in his hand to the last, Hogg in 1834 published a volume of *Lay Sermons*, and in 1835 two volumes of *Montrose Tales*. His illness ultimately assumed the form of dropsy, and after a short confinement he died November 21, 1835, having nearly completed his sixty-fifth year.

HOHENELBE, the chief town of a government district in Bohemia, is beautifully situated on both banks of the Elbe, crossed there by five bridges, on the southern spurs of the Riesengebirge, and on the north-west Austrian railway, sixteen miles northeast of Gitschin.

HOHENLOHE, a German princely family, who took their name from the territory of Hohenlohe, in Franconia, which, originally a countship and afterward a principality, lost its independence in 1806, and is now

included partly in Württemberg and partly in Bavaria. They are first mentioned as possessing in the twelfth century the castle of Holloch near Uffenheim. At an early period they extended their influence into several of the Franconian valleys, including those of the Kocher, the Jagst, the Tauber, and the Gotlach. The first count of the name was Gottfried, who was on terms of intimacy with the emperor Henry VI., and whose sons founded the lines of Hohenlohe-Bruneck and Hohenlohe-Holoch. The former became extinct in the fourth generation, and the latter in 1340 divided into the lines of Hohenlohe-Hohenlohe and Hohenlohe-Speckfeld. Of these the former became extinct in 1412, after the most of the possessions had been alienated through the marriage of the female heir; and the latter in 1551 divided into the present lines of Hohenlohe-Neuenstein and Hohenlohe-Waldenburg, which were elevated, the former in 1764 and the latter in 1744, to principalities of the empire. Hohenlohe-Neuenstein, which adopted Protestantism, became divided into the lines Hohenlohe-Neuenstein-Oehringen and Hohenlohe-Neuenstein-Langenbourg, the former of which separated into the branches of Hohenlohe-Weickersheim and Hohenlohe-Oehringen, the one becoming extinct in 1756 and the other in 1805, after which their possessions were inherited by the Hohenlohe-Neuenstein-Langenbourg line, which latter became divided into three branches—the Hohenlohe-Langenbourg, the Hohenlohe-Langenbourg-Oehringen, and the Hohenlohe-Langenbourg-Kirchberg, the last becoming extinct in 1861. The line of Hohenlohe-Waldenburg, which remained Catholic, and in which was established in 1754 the order of the Phoenix, divided itself into two branches, the Hohenlohe-Waldenburg-Bartenstein and the Hohenlohe-Waldenburg-Schillingsfürst, the former subdividing into the branches of Hohenlohe-Bartenstein and Hohenlohe-Jagstberg.

HOHENMAUTH, the chief town of a government district in Bohemia, Austria, is situated on the Lautchna, and on the Austrian States Railway sixteen miles east of Chrudim.

HOHENSTEIN, a town of Saxony, circle of Zwickau, stands on the slopes of the Erzgebirge, and on the Saxon States railway, twelve miles northeast of Zwickau. Since 1875 Ernstthal has been included within its limits.

HOHENZOLLERN, an old German princely house, from which the present dynasty of Prussia is descended, takes its name from the old castle of Zollern, or Hohenzollern, on the mountain of Zollern, about one and a half miles south from Hechingen. There is a vague tradition connecting the house with the Colonna family of Rome, or the Colalto family of Lombardy, and a more definite one which mentions a Swabian count, Thassilo of Burchardinger, as having built the castle of Zollern about the beginning of the ninth century. The first counts of Zollern of whom there is historical mention are Burchard and Wezel, apparently brothers, who in 1061 fell in one of the party feuds during the minority of the emperor Henry IV. Count Frederick III. of Zolre, who died in 1200, one of the trusted councilors of the emperors, Frederick I. and Henry VI., became count of Nuremberg in 1191, through having married the heiress of Count Conrad II. of Nuremberg. His sons, Conrad III. and Frederick IV., succeeded to the joint possession of his titles and estates, and founded respectively the Frankish and the Swabian lines. The Frankish house steadily and uninterruptedly increased its possessions and its influence; in 1363 it was raised to princely rank in the person of Frederick V.; in 1415 it obtained through Frederick VI. the electorate of Brandenburg from the emperor Sigis-

mund; and in 1701 its head, the elector Frederick III., became the first king of Prussia. The influence of the Swabian line was greatly weakened by partitions, but in the beginning of the sixteenth century it rose to some eminence through Count Eitel Frederick II., privy councilor of the emperor Maximilian I., who received from the emperor the district of Hargerloch in exchange for Rhäzüns, in the Grisons, which had come into his family by marriage. His grandson, Charles I, received in 1529 from the emperor, Charles V., the countships of Sigmaringen and Vöhringen. Eitel Frederick III. and Charles II. divided their states, the former taking Hohenzollern with the title Hohenzollern-Hechingen, the latter Sigmaringen and Vöhringen with the title Hohenzollern-Sigmaringen. Count John George of Hohenzollern-Hechingen son of Eitel Frederick III., was raised to princely rank by the emperor Ferdinand II. in 1623, and John of Hohenzollern-Sigmaringen received the same honor in 1638. In 1695 the two Swabian branches entered conjointly into an agreement with the Brandenburg line that, in case of the extinction of the male line of either of the Swabian branches, the states should be inherited by the other branch, and that if both branches became extinct the states should be inherited by the Brandenburg line. In consequence of the political troubles of 1848, Prince Frederick William, of Hohenzollern-Hechingen, and Charles Anton of Hohenzollern-Sigmaringen resigned their principalities, which consequently fell to the crown of Prussia, by whom they were taken possession of, March 12, 1850. By royal decree of May 20th of the same year the title of highness was conferred on the two princes, with the prerogatives of younger sons of the royal house. The proposal to raise Prince Leopold of Hohenzollern-Sigmaringen to the throne of Spain in 1870 was the immediate occasion of the war between France and Germany. In 1852 the lands of Hohenzollern were formed into an administrative division of Prussia. It is composed of a long narrow strip of land bounded on the northeast and west by Würtemberg and on the west and south by Baden, with an area of 440 square miles, and a population in 1875 of 66,614. During the reign of the Prussian kings of this house, beginning with Frederick I., in 1701, much of the history of Germany has been made. From the time that the Brandenburg branch of the Hohenzollerns claimed the royal sovereignty of Prussia, that state has steadily augmented in power and importance, until in 1871, after the overthrow of the French empire, and the redress of the grievances of the collateral line of Hohenzollerns, it became the nucleus and leading state of the German empire as at present constituted, and the king of Prussia took the additional dignity of hereditary emperor of Germany. There have thus been in modern times three German emperors of this dynasty, Wilhelm I., Frederick III., and the present emperor, Wilhelm II.

HOLBACH, PAUL HEINRICH DIETRICH, BARON D', *philosophe* of the Parisian school of the eighteenth century, was born at Heidelberg in the palatinate in 1723. Much of Holbach's fame is due to his intimate connection with the brilliant coterie of bold thinkers and polished wits whose creed, the new philosophy, is concentrated in the famous *Encyclopédie*.

Although an atheist, or at least a materialist of the most material school, Holbach seems to have been endowed with a more than average share of virtue, and, whether by his courtesy, gentleness, or benevolence, inspired a warm affection in all he met. Even his failings, of which his simple credulity was perhaps the most prominent, were amiable. He was one of the best informed men of his day, and his excellent memory placed at his immediate disposal all the learning he had

amassed. He published his books either anonymously or under a borrowed name, and was forced to have them printed out of France. He died in 1789.

HOLBEIN, HANS, the elder, belonged to a celebrated family of painters in practice at Augsburg and Basel from the close of the fifteenth to the middle of the sixteenth century.

The elder Holbein was a prolific artist, who left many pictures behind him. Earlier than the celebrated Basilica of St. Paul, is the Basilica of St. Mary Maggiore, and a Passion in eleven pieces, in the Augsburg gallery, both executed in 1499. Another Passion, with the root of Jesse and a tree of the Dominicans, is that preserved in the Staedel, Saalhof, and church of St. Leonard at Frankfort. It was executed in 1501. The Passion of Donaueschingen was finished after 1502, in which year was completed the Passion of Kaisheim, a conglomerate of twenty-seven panels, now divided among the galleries of Munich, Nuremberg, Augsburg, and Schleissheim. An altarpiece of the same class, commissioned for the monastery of St. Moritz, at Augsburg in 1504-8, has been dispersed and lost. The year 1512 is the date of a Conception in the Augsburg gallery, long assigned, in consequence of a forged inscription, to Hans Holbein the younger. A diptych, with a Virgin and Child, and a portrait of an old man, dated 1513, is in separate parts in the collections of Mr. Posonyi and Count Lanckoronski at Vienna. The sketchbooks of Berlin, Copenhagen, and Augsburg give a lively picture of the forms and dress of Augsburg residents at the beginning of the sixteenth century. They comprise portraits of the emperor Maximilian, the future Charles V., Kunz von der Rosen, the fool of Maximilian, the Fuggers, friars, merchants, and at rare intervals ladies.

HOLBEIN, HANS, the younger, favorite son of Hans Holbein the elder, was probably born at Augsburg about the year 1497. About 1515 he left Augsburg with Ambrose his elder brother to seek employment as an illustrator of books at Basel. His first patron is said to have been Erasmus. Hans, not overburdened with practice, wandered into Switzerland, where (1517) he was employed to paint in the house of Jacob Hertenstein at Lucerne. In 1519 Holbein reappeared at Basel, where he matriculated, and, there is every reason to think, married. Holbein settled down to an extensive practice at Basel in 1519. His versatility at this period is shown by a dead Christ (1521), a corpse in profile on a dissecting table, and a set of figures in couples; the Madonna and St. Pantalus, and Kaiser Henry with the empress Kunigunde (1522), originally composed for the organ loft of the Basel cathedral, now in the Basel museum. Equally remarkable, but more attractive, though injured, is the Virgin and Child between St. Ursus and St. Nicholas (not St. Martin) giving alms to a beggar, in the gallery of Solothurn. This remarkable picture is dated 1522. The promise which he gave at this time was immense. He was gaining a freedom in draughtmanship that gave him facility to deal with any subject. Though a realist, he was sensible of the dignity and severity of religious painting. His color had almost all the richness and sweetness of the Venetians. But he had fallen on evil times, as the next few years undoubtedly showed.

Once only, after 1526, and after he had produced the *Lais* and *Venus and Amor*, did Holbein with impartial spirit give his services and pencil to the Roman Catholic cause. The burgomaster Meyer, whose patronage he had already enjoyed, asked him to represent himself and his wives and children in prayer before the the Virgin; and Holbein produced the celebrated altarpiece now in the palace of Prince William of Hesse at Darm-

stadt, the shape and composition of which are known to all the world by its copy in the Dresden museum. The drawings for this masterpiece are among the most precious relics in the museum of Basel. The time now came when art began to suffer from unavoidable depression in all countries north of the Alps. Holbein, at Basel, was reduced to accept the smallest commissions—even for scutcheons. Then he saw that his chances were dwindling to nothing, and taking a bold resolution, armed with letters of introduction from Erasmus to More, he crossed the Channel to England, where in the one-sided branch of portrait painting he found an endless circle of clients. Eighty-seven drawings by Holbein in Windsor Castle, containing an equal number of portraits, of persons chiefly of high quality, testify to his industry in the years which divide 1528 from 1543. They are all originals of pictures that are still extant, or sketches for pictures that were lost or never carried out. Sir Thomas More, with whom he seems to have had a very friendly connection, sat to him for likenesses of various kinds. One drawing belonged, and perhaps still belongs, to Mr. Huth in London. A pen-and-ink sketch, in which we see More surrounded by all the members of his family, is now in the gallery of Basel, and numerous copies of a picture from it prove how popular the lost original must once have been. At the same period were executed the portraits of Warham (Lambeth and Louvre), Wyatt (Louvre), Sir Henry Guildford and his wife (Windsor and Mr. Frewen), all finished in 1527, the astronomer Kratzer (Louvre), Godsalve (Dresden), and Bryan Tuke (Munich) in 1528. In this year, 1528, Holbein returned to Basel, taking to Erasmus the sketch of More's family. With money which he brought from London he purchased a house at Basel wherein to lodge his wife and children, whose portraits he now painted with all the care of a husband and father (1528). He then witnessed the flight of Erasmus and the fury of the iconoclasts, who destroyed in one day almost all the religious pictures at Basel. With the exception of a portrait of Melancthon (Hanover) which he now completed, Holbein found little to do at Basel. The year 1530, therefore, saw him again on the move, and he landed in England for the second time with the prospect of bettering his fortunes. Here indeed political changes had robbed him of his earlier patrons. The circle of More and Warham was gone. But that of the merchants of the Steelyard took its place, for whom Holbein executed the long and important series of portraits that lie scattered throughout the galleries and collections of England and the Continent, and bear date after 1532. Then came again the chance of practice in more fashionable circles. Henry VIII. invited him to make a family picture of himself, his father and family, which obtained a post of honor at Whitehall. Holbein in 1538 took the opportunity of revisiting Basel, where he made his appearance in silk and satin, and *pro forma* only accepted the office of town painter. His return to London in autumn enabled him to do homage to the king in the way familiar to artists. He presented to Henry at Christmas a portrait of Prince Edward. Again abroad in the summer of 1539, he painted with great fidelity the Princess Anne of Cleves, at Duren near Cologne, whose form we still see depicted in the great picture of the Louvre. That he could render the features of his sitter without flattery is plain from this one example.

Among the more important creations of Holbein's later time we should note his Duke of Norfolk at Windsor, the hands of which are so perfectly preserved as to compensate for the shrivel that now disfigures the head. Two other portraits of 1541 (Berlin and Vienna), the Falconer at the Hague, and John Chambers at Vienna (1542), are noble specimens of portrait art;

most interesting and of the same year are the likenesses of Holbein himself, of which several examples are extant—one particularly good at Fährna, the seat of the Stackelberg family near Riga, and another at the Uffizi in Florence. Here Holbein appears to us as a man of regular features, with hair just turning gray, but healthy in color and shape, and evidently well-to-do in the world. Yet a few months only separated him then from his death-bed. He was busy painting a picture of Henry VIII. confirming the Privileges of the Barber Surgeons (Lincoln's Inn Fields), when he sickened of the plague and died, after making a will, about November, 1543.

HOLBERG, LUDVIG HOLBERG, BARON, the greatest of Scandinavian writers, was born at Bergen, in Norway, December 3, 1684, and died in 1754.

Holberg was not only the founder of Danish literature and the greatest of Danish authors, but he was, with the exception of Voltaire, the first writer in Europe during his own generation. Neither Pope nor Swift, who perhaps excelled him in particular branches of literary production, approached him in range of genius, or in encyclopædic versatility. Holberg found Denmark provided with no books, and he wrote a library for her. When he arrived in the country, the Danish language was never heard in a gentleman's house. Polite Danes were wont to say that a man wrote Latin to his friends, talked French to the ladies, called his dogs in German, and only used Danish to swear at his servants. The single genius of Holberg revolutionized this system. He wrote poems of all kinds in a language hitherto employed only for ballads and hymns; he instituted a theater, and composed a rich collection of comedies for it; he filled the shelves of the citizens with works in their own tongue on history, law, politics, science, philology, and philosophy, all written in a true and manly style, and representing the extreme attainment of European culture at the moment. Perhaps no author who ever lived has had so vast an influence over his countrymen, an influence that is still at work after nearly 200 years.

HOLCROFT, THOMAS, dramatist and miscellaneous writer, was born December 10, 1745 (old style), in Orange Court, Leicester Fields, London. He died March 23, 1809, from enlargement of the heart, brought on, it is supposed, by the failure of several of his dramatic pieces.

HÖLDERLIN, JOHANN CHRISTIAN FRIEDRICH (1770-1843), German poet, was born March 29, 1770, at Lauffen on the Neckar. He died June 7, 1843.

Hölderlin's writings are the production of a beautiful and sensitive mind, a mind of high ideas and noble impulses; but they are intensely, almost morbidly, subjective, and they lack real human strength. Perhaps his strongest characteristic was his passion for Greek subjects, and the natural result of this was that he almost entirely discarded rhyme in favor of the ancient verse measures. His poems are all short pieces; of his tragedy only a fragment was written. *Hyperion, oder der Eremit in Griechenland*, is thus his one important work; and even to this a sequel is wanting. It may be called a prose poem, and is written in the form of letters. Its exquisite language, the purity of its tone, the sad philosophical vein which permeates it, together with its autobiographic character, claim for it a unique position among German classics.

HOLESCHAU, HOLLESCHAU, or HOLESOV, chief town of a government district in Moravia, Austria, circle of Hradisch, is situated on the Russawa, twenty miles north-northeast of Hradisch.

HOLIBUT, or HALIBUT (*Hippoglossus vulgaris*), is the largest of all Flat-fishes, specimens of five feet in

length and of 100 lb. in weight being frequently exposed for sale in the markets. Indeed, specimens under two feet in length are very rarely caught, and singularly enough, no instance is known of a very young specimen having been obtained. The holibut is much more frequent in the higher latitudes of the temperate zone than in its southern portion; it is a circumpolar species, being found on the northern coasts of America, Europe, and Asia, extending in the Pacific southward to California.

HOLINSHED, or HOLLINSHED, RAPHAEL, author of *Chronicles of England, Scotland, and Ireland*, flourished in the sixteenth century. He belonged to a family settled at Bosley, in Cheshire, and according to Anthony Wood he was educated at one of the universities and took orders in the church. In the compilation of the *Chronicles* called by his name he bore a leading part, but he received extensive and important aid from Stow the antiquary, Harrison, chaplain to Lord Cobham, Hooker (*alias* Vowell), an uncle of the divine of that name, and Francis Boteville (*alias* Thin), a learned antiquary.

HOLKAR, the title of the mahārājā of INDORE, (*q. v.*) whose territories are often designated Holkar's Dominions.

HOLLAND is the most usual English name of the country which is nationally designated the Kingdom of the Netherlands (*Koninkrijk der Nederlanden*). The word, which is popularly explained as if it were Hollowland, and referred to the same physical fact which has given rise to the terms Netherlands and the Low Countries, appears in an older form as Holtland, and is thus evidently equivalent to Wood-land. In French the usual expression is Pays-Bas, and in German Niederlande.

There is no country in Europe in which the character of the territory has exercised so great an influence on the inhabitants as in the Netherlands; and, on the other hand, no people has so extensively modified the condition of its territory as the Dutch. In a description of Holland, consequently, the greatest importance must be attached to the physical conformation of the country as it was and is; and most of the peculiarities of the political and social condition of the people must be considered in connection with this conformation.

The size of Holland, being subject to perpetual diminution and increase, cannot be indicated by a definite figure except as at some definite period; on the one hand, there is loss of area still going on in consequence of the erosion of the coasts, and, on the other hand, this is more than counterbalanced by a continual acquisition of new ground due more especially to "impoldering" and draining operations.

The Kingdom extends from $53^{\circ} 32' 21''$ (Groningen Cape on Rottum Island) to $50^{\circ} 45' 49''$ N. latitude (Mesch in the province of Limburg), and from $3^{\circ} 23' 27''$ (Sluis in the province of Zeeland) to $7^{\circ} 12' 20''$ E. longitude (Langakkerschans in the province of Groningen). The greatest length from north to south, viz., that from Rottum Island to Eysden near Maestricht, is estimated at 164 miles, and the greatest breadth from southwest to northeast, or from Zwin near Sluis to Losser in Overijssel, at 144 miles. If the Zuyder Zee, the parts of Prussia which encroach on the eastern side, and the projecting portions of Limburg and Zeeland are disregarded, the general form is almost an oblong. With the exception of Greece and Great Britain, no country of Europe has so many inlets of the sea as Holland.

The Netherlands are bounded on the east by the Prussian provinces of Hanover, Westphalia, and the province of the Rhine, and on the south by the Belgian

provinces of Liège, Limburg, Antwerp, and East and West Flanders. A purely geographical boundary is formed to the west and the north by the North Sea, at the northeast corner by the Dollart, and from Stevensweert southward to the extreme corner of Limburg (near Eysden) by the Maas or Meuse. Natural ethnographic frontiers, such as occur where two neighboring peoples of different origin, race, character, customs, and language are sharply marked off from each other, do not exist in the case of the Netherlands. The Low German element, indeed, of which the Netherlands form as it were the kernel, spreads beyond Dutch limits both northeast along the coast of the German Ocean and southwest into Belgium.

Sea-dykes are found along the northern coasts, the coasts of the provinces which border on the Zuyder Zee, and the coasts of the islands of Zeeland and South Holland so far as they are not protected by dunes. Only in a few places, it will be seen, are the sea-dykes unnecessary; as, for example, in Friesland between Stavoren and Olde Mirdum (the bold and steep Roode and Mirdum cliffs) and near Doornspijk, three miles south of Elburg, where there are high grounds which stretch six miles to the southwest of Harderwijk. The earthen dykes are protected by stone-slopes and by piles, and at the more dangerous points also by "zinkstukken" (sinking pieces), artificial structures of bulrushes, reeds, and branches laden with stones, and measuring some 400 yards in circuit, by means of which the current is to some extent turned aside. The Westkappel dyke is 12,468 feet long and 23 high, has a seaward slope of 300 feet, and is protected by rows of piles and basalt rocks. On its ridge, thirty-nine feet broad, there is not only a roadway but a service railway. When it is remembered that the woodwork is infested by the pile-worm (*Teredo navalis*), the ravages of which were discovered in 1731, the enormous expense incurred in the construction and maintenance of the 1,550 miles of sea-dykes now existing may be imagined. The cost of construction is not over-estimated at 150,000,000 guilders, or £12,500,000.

The Dutch islands may be divided into two main classes—(1) those surrounded on all sides by the German Ocean or its inlets, and (2) those surrounded entirely or in great part by river arms, and separated by these from the mainland or from each other. The first division again comprises two groups—(a) the islands Texel, Vlieland, Terschelling, Ameland, Schiermonnikoog, and Rottum, which stretch in a long arc from the north point of North Holland to the mouth of the Ems, and indicate the old coast-line, so that they belong to the same physico-geographical group with the islands along the German coast; and (b) the islands Wieringen, Marken, Urk, and Schokland, which are the relics of the stretch of country formerly comprising the present bed of the Zuyder Zee. In the second class are to be reckoned the delta of the river Yssel (Camper Island) and the islands belonging to the contiguous deltas of the Rhine, the Meuse, and the Scheldt, including the island of Betuwe between the Rhine and the Waal and the archipelago of South Holland and Zeeland.

The varying characteristics of the coasts in different places give rise to correspondingly different industries. As regards trade and navigation, the west coasts with their shallows and sandbanks can be approached only by small vessels of light draught (visscherspinken) unless where access is afforded by the inlets of the sea, especially the mouth of the West Scheldt at Flushing, that of the East Scheldt at Zierikzee, the Brouwershaven inlet between the islands of Schouwen and Goeree, the Goeree inlet at Helvoetsluys, the Marsdiep at the Helder, and the mouth of the Ems at Delfzijl, or where a way

has been opened up by engineering works as at Rotterdam and Amsterdam (by the new waterway to the sea and the canal to Ymuiden). As we proceed from southwest to northeast the places along the coast become less and less important; in the provinces of Groningen and Friesland the approach to the mainland is obstructed by the Wadden or Shallows; and on the coast of the Zuyder Zee are those harbors, for the most part rendered useless by alluvial accretions, which have been so well described by Harvard in his *Villes Mortes du Zuyderzee*. Along the greater part of these coasts the population is engaged in the fisheries rather than in trade, especially when the neighborhood of a great town (as Alkmaar for Egmond, Haarlem for Zandvoort, Leyden for Katwijk, the Hague for Scheveningen) secures a good market or a ready means of exportation. Many fishing villages on the west coast, *e. g.*, Scheveningen, Domburg, and Zandvoort, have in recent years acquired repute as watering places with both natives and foreigners.

The climate of Holland is such as might be conjectured from its geographical position and its generally low level. Situated in the temperate zone between 50° and 53° N. latitude, it shows a difference in the lengths of day and night extending in the north to nine hours, and there is a correspondingly wide range of temperature; it also belongs to the region of variable winds.

It cannot be said that the climate is particularly good; indeed to strangers it is rather the reverse of pleasant. Fever, colds, and, when proper precautions are not taken, chest disease and consumption, are results of the changeableness of the weather, which may alter completely within a single day. The heavy atmosphere likewise, and the necessity of living within doors or confined localities, cannot but exercise an influence on the character and temperament of the inhabitants. Only of certain districts, however, can it be said that they are positively unhealthy; to this category belong some parts of Holland, Zealand, and Friesland, where the inhabitants are exposed to the exhalations from the marshy ground, and the atmosphere is burdened with the sea-fogs.

The density of the population must, apart from other causes, increase through the acquisition and cultivation of new land, and it visibly differs very greatly according to the difference of the soil in the different provinces.

The greater density of population in the Holland provinces as compared with the Drenthe cannot be explained, however, merely by the character of the soil; the variety of industries and the great number of large towns contribute to the inequality. All the towns with 100,000 inhabitants and upward (Amsterdam, Rotterdam, and the Hague) are situated in the provinces of Holland; of the thirty-six communes with more than 10,000, nine are in Holland, none in Drenthe; of the thirty-five communes between 10,000 and 4,000, nine are in Holland and two in Drenthe.

As the density of the population varies within the narrow limits of the Netherlands, so varies likewise the origin of the people. Although ethnographically the whole population belongs to the Indo-Germanic family, or more definitely to the Teutonic branch of it, the descendants of the Frisians may be clearly distinguished in the northwest. The mouths of the Meuse separate these from the descendants of the Franks, who pushed eastward across the Meuse but never settled beyond the Waal, while the territory of the Saxons, who came later from the east, extends no further than to the Utrecht Vecht. The descendants of the Saxon consequently lie between those of the two first-named peoples, although naturally much commingling has taken place between Frisians and Saxons, and Saxons

and Franks, especially in the towns and on the newly-acquired lands. The representatives of the Semitic stock (Portuguese or German Jews), though their influence is not unimportant, number only 50,000 or 60,000, of whom about 40,000 reside at Amsterdam. The descendants of the three Teutonic peoples above named are very slightly distinguished from each other by their physical, intellectual, and moral characteristics, and all the less so because the Dutch type is not itself strongly marked and bears the traces of foreign commixture; for many Flemings and Brabanters settled in the country at the time of the revolt against Spain, many Germans, Englishmen, and Scandinavians during the prosperity of the republic, and many Frenchmen after the revocation of the edict of Nantes. The differences most clearly discernible are in the old local laws, in the peculiar customs, and above all in the dialects. Among these last must be distinguished the Holland dialect (Hollandsch), spoken in the provinces of Holland and part of Utrecht; the Zealand dialect (Zeeuwsch, in Staats Flanders inclining toward Flemish); the Brabantine (modified), also spoken in a part of Limburg and the south of Guelderland; the Lower Rhenish, which is again subdivided into the Guelderland, the Overijssel, and the Drenthe dialects; and, finally, the Groningen dialect. The peasant or country Frisian forms a completely separate language with a literature of its own.

The government of the Netherlands is regulated by the constitution of 1815, revised in 1848, under which the king's person is inviolable and the ministers are responsible. The crown is hereditary in both the male and the female line according to primogeniture; but it is only on the complete extinction of the male line that females can come to the throne. The crown prince or heir-apparent is the first subject of the king, and bears the title of the Prince of Orange. The king alone has executive authority. To him belong the ultimate direction of foreign affairs, the power to declare war and peace and to make treaties and alliances, the supreme command of the army and navy, the supreme administration of the finances, and of the colonies and other possessions of the kingdom, and the prerogative of mercy. By the provisions of the same constitution he establishes the ministerial departments, and shares the legislative power with the first and second chambers. The heads of the departments to whom the especial executive functions are intrusted are eight in number—ministers respectively of the interior, of public works, of justice, of finance, of war, of marine, of the colonies, and of foreign affairs. They are appointed and dismissed at the pleasure of the king, usually determined, however, as in all constitutional states, by the will of the nation as indicated by its representatives. The members of the first chamber are chosen by the provincial states from among those who bear the greatest burden of direct taxation in each province, the proportion of persons thus eligible being one to every 3,000 of the population. The duration of parliament is nine years, one-third of the members retiring every three years. The retiring members are eligible for reëlection. The members of the second chamber are chosen in the electoral districts by all citizens of full age who pay direct taxes varying according to local circumstances from 20 to 160 guilders. One member is elected for every 45,000 of the population; they must be at least thirty years old, and they cease to be members if they take a salaried government appointment. They discuss all laws, and have the right of proposing amendments. Their term is four years, but they are reëligible. All communications from the king to the states-general, and from the states to the king, as well as all general measures relating to internal

administration or to foreign possessions, are first submitted to the consideration of the council of state, which also has the right of making suggestions to the king in regard to subjects of legislation and administration. The king appoints the vice-president of the council, which consists of fourteen members; he is himself the president, and can name councilors, to the number of not more than fifteen, for special service.

The provisional administration is intrusted to the provincial states, which are returned by direct election by the same electors as voted for the second chamber. The term is for six years, but part of the members retire every three years. The president of the assembly is the royal commissioner for the province. As the provincial states only meet a few times in the year, they name a committee of deputy-states to which the management of current general business is intrusted, and which at the same time administers the affairs of the communes. At the head of every commune stands a communal council, whose members are chosen by the inhabitants for a definite number of years. The president of the communal council, the burgomaster, is named by the king in every instance for six years, and along with the magistrate to be chosen by and from the members of the council is charged with the ordinary administration. The provinces, as already stated, are eleven in number (the grand-duchy of Luxembourg, over which the king has control, is not incorporated with the kingdom).

The administration of justice is intrusted (1) to the high council, the supreme court of the whole kingdom, which holds its sessions at the Hague, and is the tribunal for all high government officials and for the members of the states-general; (2) to the five courts of justice for criminal cases, and for appeal in more important police and civil cases; (3) to courts established in each arrondissement; (4) to cantonal judges appointed over a group of communes, whose jurisdiction is restricted to claims of small amount (under 200 guilders), and to breaches of police regulations, and who at the same time look after the interests of minors.

The standing army consists of infantry, cavalry, artillery, engineers and gendarmerie, forming together a force of 60,000 men, with 3,000 horses. Less than half, however, is kept in arms the whole year. The soldiers are raised partly by voluntary enlistment and partly by conscription. The soldiers are selected from the males who have entered their twentieth year and are not exempted for special reasons. The term of service in time of peace is five years, but may be extended in time of war; the conscript recruits, however, so far as the number of volunteers permits, are kept under arms for a few months only. A portion of the annual contingent is appropriated to the marine service. In the communes there are "schutterijen," militia "trainbands," which in time of war serve for the defense of the country, and at all times for the maintenance of order. Their actual term of service lasts only five years, but every male inhabitant from his twenty-fifth to his thirty-fourth year is liable to be called out.

The strength of the navy in 1889 was 147 men-of-war, of which twenty-four were iron-clads.

The inhabitants of Holland enjoy full religious as well as political liberty. Not only is the free profession of his religious opinions guaranteed to everyone by the constitution; the same protection is accorded to all the various ecclesiastical bodies, all the adherents of the different creeds have equal civil and political rights, and equal claims to public offices, dignities and appointments; and all denominations possess perfect freedom of administration in everything relating to their religion and its exercise. The various denominations are subsidized by the state.

Primary education is being more widely diffused year after year, and at the same time receiving increased support from the state. There are no bilingual schools in Holland, and teachers discourage the use of the dialects. For secondary education there are "burgher schools" (partly day schools, partly night schools). The higher education is provided for in the four universities of Leyden (founded in 1575), Utrecht (1636), Groningen (1614), and Amsterdam (1877). A national institution at Leyden for the study of the languages, geography and ethnology of the Dutch Indies has given place to communal institutions of the same nature at Delft and at Leyden, founded in 1864 and 1877. Military and naval instruction are provided for by corps schools, by a training battalion at Kampen, an artillery training company at Schoonhoven, and scientific courses for the several corps by the royal military academy (founded 1828), the "school of war" for officers, the royal navy institute at Willemsoord (1856), and by training ships at Amsterdam, Rotterdam, and Helvoetsluys for apprentice boat-swains, sailors, cabin-boys, pilots and engineers. For the education of medical practitioners, civil and military, the more important institutions are the national obstetrical college at Amsterdam, the national veterinary school at Utrecht, the national college for military physicians at Amsterdam, and the establishment at Utrecht for the training of military apothecaries for the East and West Indies.

Of the numerous institutions in Holland for the encouragement of the sciences and the fine arts, the following are strictly national: The royal academy of sciences (1855), the royal Netherlands meteorological institute (1854), the national academy of the plastic arts, the royal school of music, the national archives, the royal picture gallery at the Hague, and the national gallery of modern masters in the Pavilion at Haarlem, the national museum of antiquities, the national museum of ethnography at Leyden, the royal collection of curiosities at the Hague, etc. Provincial scientific societies exist at Middelburg, Utrecht, Bois le Duc, and Leeuwarden, and there are private and municipal associations, institutions, and collections in a large number of the smaller towns. Among others of general utility are the society for the service of the community (*Maatschappij tot nut van't algemeen*, 1784), and the geographical society at Amsterdam (1873), Teyler's Stichting or foundation, and the society of industry at Haarlem, the royal institute of languages, geography, and ethnology of the Dutch Indies (1851) and the Indian society at the Hague, the royal institute of engineers at Delft (1848), the association for the encouragement of music at Amsterdam, etc.

The agricultural methods vary according as the soils are sandy or clay. In the first the "three-crop" system (two crops of rye and one of buckwheat) differs widely from the careful Flemish method of cultivation, in which even the pastures are manured. On the clay there is still greater variety both in the modes of treatment and in the amount of care bestowed on weeding and draining. The produce of the land is thus very different in the various provinces for the same soil. The general value of the crops is gradually rising. Improved education and the influence of local associations for the advancement of the interests of agriculture have contributed to the result. The woods, or rather the plantations, covering 6 per cent. of the acreage, consist of — (1) the so-called forest timber (*opgaandhout*; French, *arbres de haute futaie*),—including the beech, oak, elm, poplar, birch, ash, willow, and coniferous trees; and (2) the **copse wood** (*akkermaal* or *hakhout*),—embracing the alder, willow, beech, oak, etc. This forms no unimportant branch of the national wealth.

Stock-breeding varies in the different provinces. For cattle, Friesland and North and South Holland take the lead as regards both quality and numbers; sheep are best in Texel and North Holland, and most numerous in Drenthe, where their preponderance is due to the number of commons which still remain unbroken up. Pigs, for which the lowlands are peculiarly favorable, are reared in all the provinces. Goats, mainly kept for their milk, are most numerous in Guelderland and North Brabant. Guelderland, Friesland, Zeeland, and Groningen possess the greatest number of horses. Poultry, especially fowls, are generally kept. Bee culture is mainly carried on in buckwheat and heath districts (Guelderland, Overijssel, Drenthe, the Gooiland, and Utrecht). A bee market is held at Veenendaal in Utrecht. Stock-breeding is mainly carried on along with dairy-farming and haymaking on the alluvial soils; and there the cereal crops give way to fodder plants. The permanent pasture in recent years extends to some 2,500,000 of acres, and clover, artificial meadows, etc., occupy about 400,000. The production of milk, butter, and cheese amounts to the value of 90,000,000 of guilders (40 cents each); butcher meat produces 35,000,000, and wool, hides, fowls, and game 10,000,000; while horse-breeding also yields a total of 10,000,000.

In the densely peopled Netherlands, with no extensive forests, hunting forms rather an amusement than a means of subsistence, the only exception being the pursuit of wild-fowl (ducks, geese and snipes). Hares, partridges, wood-snipes, finches, and thrushes are the only form of game; a few roebucks and deer are found in Overijssel and Guelderland; rabbits are numerous in the dunes, and seagulls' eggs are gathered in the north of Texel, which consequently bears the name of *Eijerland* (*i.e.*, Eggland).

Much more important as a means of subsistence are the fisheries. They are divided into the "deep-sea fishery" (*buitengaatsch*) in the German Ocean, and the "inner" fisheries (*binnengaatsch*) in the Zuyder Zee, the rivers of Zeeland, and the inland waters. The deep-sea fishery may be further divided into the great (the so-called "salt-herring") fishery, mainly carried on from Vlaardingen and Maassluis, and the "fresh-herring" fishery, chiefly pursued at Scheveningen, Katwijk, and Noordwijk. The deep-sea fisheries also yield cod and flat fish. In the Zuyder Zee flat fish, herrings, anchovies, and shrimps are caught off the islands of Urk and Marken and the coast towns of Vollenhove, Kampen, Harderwijk, Huizen, and Vollandam; and there are oyster banks near Texel. In the Zeeland rivers oysters and mussels are obtained at Bruinisse, Philippine, and Graauw, and anchovies at Bergen-op-Zoom; while salmon, perch, and pike are caught in the Meuse, the Lek, and the Merwede, and eels in the Frisian lakes. The fisheries not only supply the great local demand, but allow large exports.

To obtain a correct idea of the trade of the Netherlands greater attention than would be requisite in the case of other countries must be paid to the inland traffic. It is impossible to state the value of this in definite figures, but an estimate may be formed of its extent from the number of ships which it employs in the rivers and canals, and from the quantity of produce brought to the public markets or daily transported by thousands of carts and delivered by the peasant direct to the salesman. Of the market traffic, even in places of secondary rank, the following facts may give some idea. There are yearly brought to market at Gorcum and Hoorn from 10,000 to 13,000 head of cattle; at Barneveld, more than 20,000 sheep; at Alkmaar about 10,000,000 and at Hoorn 5,500,000 pounds of cheese; at Delft 1,500,000 pounds of butter and 2,000,000 pounds

of cheese; at Meppel 3,000,000 pounds of butter; at Leeuwarden 9,000,000 to 11,000,000 pounds of butter, 2,000,000 pounds of cheese, and 7,500,000 pounds of grain and seeds; at the Overijssel markets Zwolle, Deventer, and Kampen, and at Steenwijk and Almelo, 7,500,000 pounds of butter; at Utrecht 770,000 and at Groningen 330,000 bushels of grain and seeds.

The foreign trade, although less than it was formerly, still continues to be considerable in proportion to the size of the country.

The six ports which take the largest share in the foreign trade are Amsterdam, Rotterdam, Helder, Dort, Schiedam, and Harlingen; at a considerable distance follow Groningen, Middelburg, Vlaardingen, Purmerend, Zaandam, Edam, Zwolle, Kampen, and Delfzijl. The returns of recent years show best in the case of the South Holland towns; but it must be kept in view that the direct imports, the so-called "proper trade," are most important at Amsterdam, while a great part of the commercial business at Rotterdam belongs to the commission and transit trade. For exports Rotterdam is by far the most important, sending out nearly thrice as much as Amsterdam.

An examination of its lists of exports and imports will show that Holland receives from its colonies its spices, coffee, sugar, tobacco, indigo, cinnamon; from England, Prussia, and Belgium its manufactured goods and coals; grain from the Baltic provinces, Archangel, and the ports of the Black Sea; peas and beans from Prussia, timber from Norway and the basin of the Rhine, yarn from England, wine from France, hops from Bavaria and Alsace; while in its turn it sends its colonial wares to Germany, its agricultural produce to the London market, its fish to Belgium and Germany, and its cheese to France, Belgium, and Hamburg, as well as England. The briskest trade is carried on with Germany and England; then follow Java, France, Russia, the United States, etc.

The mineral resources of Holland give no encouragement to industrial activity, with the exception of the coal mining in Limburg, the smelting of iron ore in four furnaces in Overijssel and Guelderland, the use of stone and gravel in the making of dykes and roads and of clay in brickworks and potteries, the quarrying of stone at St. Pietersberg, etc. Still the industry of the country has developed itself in a remarkable manner since the separation of Belgium, and that in spite of the lack of iron and coal, and the rivalry of other productive forms of labor. The greatest activity is shown in the cotton industry, which especially flourishes in Twente (in Overijssel) and also at Haarlem and Veenendaal. In the manufacture of woolen goods Tilburg ranks first, followed by Leyden, Utrecht, and Eindhoven; that of half woolens is best developed at Roermond and Helmond. The cotton and woolen manufactures together furnish employment to 20,000 hands. The linen manufacture is carried on especially in Meierij van den Bosch, Helmond, Boxtel, Woensel, etc. Even ironworks and machine factories have greatly increased since the free importation of the raw material was permitted—for example, at Amsterdam and at Fijenoord opposite Rotterdam; and in this department more than 6,000 workers are employed throughout the country. It need hardly be said that shipbuilding is of no small importance in the Netherlands, not only in the greater but also in the smaller towns along the rivers and canals; and it is naturally associated with rope-spinning and other auxiliary crafts. Among other noteworthy branches of industry are the making of cigars and snuff, especially at Eindhoven, Amsterdam, Utrecht, and Kampen; diamond cutting at Amsterdam; beet-root sugar refining at Amsterdam; paper-making in the

Veluwe, on the Zaan, and in Limburg; shoemaking and leather-tanning in Brabant (Langstraat); mat-plaiting and broom-making at Genemuiden and Blokzijl; the manufacture of glass, crystal, and earthenware at Maastricht; carpet-weaving at Deventer; working in gold and silver in North and South Holland and on a smaller scale at Schoonhoven; and the distillation of brandy, gin, and liqueurs at Schiedam, Rotterdam, and Amsterdam. The number of hands occupied in the manufactories throughout the whole of the Netherlands is estimated at about 100,000, of whom three-fourths are settled in North and South Holland, North Brabant, and Overijssel.

As the development of trade and industry and agriculture was promoted by the improvement of education and the abolition of transit and export dues, and the lessening of import dues, so also has it been advanced by the improvement of the means of communication, and of the postal and telegraph systems. The waterways of the country are perhaps more extensive in proportion to area than in any other country in the world. The roads are divided into national or royal roads, placed directly under the control of the "waterstaat" and supported by the state; provincial roads, under the direct control of the states of the provinces, and almost all supported by the provincial treasuries; communal and polder roads, maintained by the communal authorities and the polder boards; and finally, private roads. The system of national roads, mainly constructed between 1821 and 1827, but still in process of extension, brings into connection nearly all the towns. The construction of railways was long deferred and slowly accomplished: the "Holland Railway" was laid down in 1839-47, the Rhine Railway in 1843-56, the Aix-Maastricht-Landen line in 1853-56, and the Dutch-Belgian in 1853-54. All the other lines, *e.g.*, that from Maastricht to Liège, the Central Railway, the Nimeguen line, the Almelo-Salzburg line, the State Railway system, etc., have been constructed since 1861, a large number of them having been opened about 1863 and 1864. A great improvement has in consequence been effected in the communication.

The Dutch colonies, originally mere trading communities, have so much increased in importance, through the cultivation of their various vegetable products, the reclaiming of their waste lands, and the working of their mines, that they cannot be left altogether out of view in considering the trade and finances of the mother country. The Dutch colonies in the East Indies, situated between 30° N. latitude, and 6° S. latitude, and between 95° and 141° E. longitude, comprise an area of 600,000 square miles with a population of about 23,000,000, among which are 35,000 Europeans, 319,000 Chinese, 15,000 Arabs, and 10,000 other immigrant Asiatics. For convenience of supervision they are divided into the great Sunda (Soenda) Islands, the Smaller Sunda Islands, and the Moluccas—a division which is based neither on political nor on ethnological considerations, nor on the phenomena of animal or vegetable distribution. The Great Sunda Islands are Java, Sumatra, Celebes, and Borneo, all with subsidiary islands; the Smaller Sunda Islands comprise Bali, Lombok, Soembawa, Flores, Sandalwood Island and Timor; the Moluccas include Halmaheria, Ceram, Buru (Boeroe), Amboyna, Banda and the southeastern groups, besides Western New Guinea. The West Indian possessions of Holland include Dutch Guiana or the government of Surinam, and the Dutch Antilles or the government of Curaçoa and its dependencies (St. Eustatius, Saba, the southern half of St. Martin, Curaçoa, Bonaire, and Aruba), a total area of

60,000 square miles, with 90,000 inhabitants, of whom a small portion are Europeans, and the rest negroes and other people of color, Chinese, and other emigrants. The East Indian possessions yield an annual average contribution, as already stated, of over £800,000; the West Indian, on the other hand, require aid to the amount of £500,000 or £600,000 yearly.

The character of the Dutch may be largely explained by their history, the conformation of the country, their means of subsistence, their strife with the sea, and their struggles to maintain their independence against Spain and against hostile neighbors. The love of freedom and independence is the leading element in their character; the peculiarity of their soil has constrained them to be industrious and economical; their contest against the sea, their wars, and their distant expeditions have trained them to bravery and self-possession; and their liberality has been stimulated by the disasters which, falling upon one to-day, might be the lot of any other to-morrow. Of course the virtues of the Dutch are apt to be distorted to vices: their composure not seldom becomes indifference; their tendency to reflection makes them laggard in action and deficient in enterprise; their love of liberty degenerates into an extravagant sense of independence that is more concerned about rights than about duties. Sociability is by no means a dominant characteristic of the Dutch; they speak little and laugh less. But their appearance and expression give a poor indication of their sterling qualities. Their general sincerity and uprightness are evident to every one whose own respectability gains him admission, on terms of familiar intercourse, to the respectable circles of Dutch society.

History.—The oldest inhabitants of Holland of whom anything is known were of Celtic origin; so much may be gathered from scanty remains found in cairns, from a few proper names, such as Nimeguen (Nimwegen) and Walcheren, and from the Druid altars found in that island. In Cæsar's day the whole district between the Rhine and the Scheldt was occupied by Belgæ, the bravest of Celts, while the Betaw, the "good meadow," the Insula Batavorum, was peopled by a portion of the Germanic tribe of the Chatti, and provided first the stoutest foes and then the most serviceable allies of the Roman empire. But if the Batavi were the most distinguished of the Germanic tribes in the country, the "free Frisians" (see FRISIANS), who filled the whole northern portion of it, were by far the most important; in addition to them, and mostly on the borderland, were others, Usipetes, Bructeri, Sicambri, Chamavi, Ebuones, and the like, of whom we know little but the names.

The first Christian church in the Netherlands was founded in the time of Dagobert I., who had reduced the Frisians and Saxons at the town of Wiltenberg, afterward Utrecht, between 622 and 632. But the true apostle of the Netherlands was Willibrord the Northumbrian, first bishop of that see (695). He made Utrecht the center from which Christian light spread across a wide circle of heathendom; and under the protection of Pippin of Heristal, the new faith was so firmly planted in those parts, that when Willibrord died Limburg, North Brabant, Utrecht, and other districts had accepted the faith of the Franks. After Willibrord, Christianity had in that part of Europe another stout champion, Wolfram of Sens, who had nearly persuaded the Frisian king, Radbod, to be a Christian; and lastly in 755, St. Boniface, "the apostle of the Germans," was martyred at Dokkum in Friesland while preaching among the heathen. Toward the end of the century the stern methods of Charles the Great completed the conversion of the Netherlands.

During the early period of Dutch history the country passed successively under Roman rule; then under the dominion of the Frankish empire, with an ever-changing lordship, as that empire was torn asunder by internal factions, during which period it suffered from incursions by the Norsemen, till in the eleventh century the nucleus of the present Holland was formed under the rule of the counts of Holland, which dynasty lasted for nearly four hundred years. This line of rulers began with Count Dirk and ended with John I., who died in 1300. At this point Holland (which had continued its connection with the German empire, and suffered correspondingly in the fluctuations of politics which that government underwent) became independent.

The fragments of Nether Lorraine, Holland, Guelderland, Utrecht, Brabant, and Flanders paid little heed to their nominal lord; Holland especially, so far from the center of the empire, so nearly forgotten in the greater troubles of Italy or Switzerland, was left to herself. She made her own laws, imposed river-dues (a recognized imperial right), named her own officers, held high court of justice, coined money, made peace or war at will. Even the *de jure* authority of the empire over Holland is a matter of doubt, much debated by publicists and historians.

When John of Avennes succeeded in 1299 as first count of the house of Hainault, the Hollanders were willing to receive him, the Zealanders not; and a long struggle between the provinces ensued. In 1301 he coerced Utrecht into alliance, and got the bishopric for his brother Guy. In 1304 the Flemings were driven out of Holland, and John II. was for a few months real lord of the country. He died that year, and was succeeded by his son William III. "the Good" (1304-1337), who made peace with Flanders in 1323, settled the outstanding quarrel between Holland and Zealand, united the Amstelland and its city Amsterdam to his territories, encouraged civic life, and developed the resources of his country. He also entered into close relations with the states of Europe, having married Johanna of Valois, niece of the French king; in 1323 the emperor Louis the Bavarian wedded his daughter Margaret, and in 1328 his third daughter, Philippa of Hainault, was given to Edward III. of England. William III. was in all respects a great prince, and an acute statesman. In 1337 he died, and was succeeded by his son William IV., who was killed fighting against the Frisians in 1345. He left no children, and the question as to the succession now brought on Holland a time of violent civil commotions. The country was claimed by Margaret, William's eldest sister, as well as by Philippa of Hainault, or, in other words, by Edward III. of England. Margaret eventually succeeded, siding with the older nobles, and being, therefore, not well received by the towns. These are the days in which came up the famous parties of "Kabbeljaus" and "Hoeks," the "Cods" and the "Hooks," the fat burgher fish and the sharp steel-pointed nobles who wanted to catch and devour them. After much buffeting and many changes of fortune, Margaret resigned her lordship in 1349 in favor of her second son William, but again resumed it in 1350. Then the struggle between nobles and cities broke into open war. Edward III. came to Margaret's aid, winning a sea fight off Veere in 1351; a few weeks later the Hooks and the English were defeated by William and the Cods at Vlaardingen—an overthrow which ruined Margaret's cause. She made peace with her son in 1354, and died two years later. He, however, shortly after fell mad; so that in 1358 the Hooks had to call in his younger brother, Albert of Bavaria, to be stadtholder or "ruwaard" in his stead; he ruled well, and restored some order to the land. In the latter part of his life he went

over to the Cods, a step which led to another outbreak of civil war which lasted until 1395. In 1404 he died, and was succeeded by his son William VI., who upheld the Hooks with all his power, and secured their ascendancy. He died in 1417, leaving only a daughter, Jacoba (or Jacqueline), wife of John of France, who died that same year. Again was Holland rent with civil strife; the Hooks, as before, readily accepting a female sovereign, while the Cods declared for John of Liège. Jacoba was granddaughter of Philip of Burgundy, who behaved very ill toward her; her romantic and sad life has rendered her the most picturesque figure in all the history of Holland; she struggled long against her powerful kinsfolk, nor did she know happiness till near the end of her life, when she abandoned the unequal strife, and found repose with Francis of Borselen, ruwaard of Holland, her fourth husband. Him Philip the Good of Burgundy craftily seized, and thereby in 1433 Jacoba was compelled to cede her rights over the counties of Holland, Zealand, Friesland, and Hainault. Consequently, at her death in 1436, as she left no children, Philip seized on all her lands. He already held much of the Netherlands; he had inherited Flanders and Artois, had bought Namur, had seized Brabant, with Limburg, Antwerp, and Mechlin; he now got Holland, Zealand, and Hainault, with a titular lordship over Friesland; a few years later he became lord also of Luxembourg. By this incorporation with the possessions of the house of Burgundy, the commercial and artistic life of Holland was quickened, but political liberties suffered; for the rule of the "good duke" was far from being good. It was a time of luxury and show, of pageants and display, of the new and brilliant Order of the Golden Fleece (1430), and of the latter days of feudalism, with all its brilliancy, corruption and decline in the presence of the new monarchical spirit of Europe. Holland, however, at first contented herself with growing material prosperity; her herring fishery, rendered more valuable than ever by the curing process discovered or introduced by Beukelzoon, brought her fresh wealth; and her fishermen were unconsciously laying the foundations of her maritime greatness. It was in the days of Duke Philip that Laurenz Koster of Haarlem contributed his share to the discovery of printing; the arts and learning of the Renaissance began to flourish greatly. The Burgundian dukes rivaled their contemporaries the Medici; under them grew up the Flemish school of painters, headed by the Van Eycks and Memling; architecture advanced as stately churches and town-houses were built; the dukes collected priceless manuscripts, founded libraries, and encouraged authors. But this speedy growth in art and letters belonged more to Flanders and Brabant than to Holland or Zealand.

In short, throughout the Burgundian time Holland plays but an insignificant part; and it may merely be remarked that the friendship of the dukes for the nobility did that class more harm than their hostility to civic liberties hurt the towns; for the lavish waste of Philip's court impoverished the nobles, and the wars of Charles destroyed them. After their days the Netherlands nobility were never again powerful. The church also suffered; it was enriched and corrupted by Philip, and was consequently very loyal to him; but his favor instead of strengthening it made the Reformation necessary. The cities, though oppressed and heavily taxed, grew stronger; and, when Duke Charles perished at Nancy, they at once stood out for their rights, and obliged his sole heir, the duchess Mary, not unwillingly, to grant them the "Great Privilege" of March, 1477, which affirmed the power of the cities and provinces to hold diets, and reserved to the estates a voice in the declaration of war, and authority to approve of the choice she

might make of a husband. It was declared that natives alone might hold high office; no new taxes should be laid without the approval of the estates; one high court of justice was established for Holland, Zealand, and Friesland; the Dutch language was made official. Thus came to an end the centralizing despotism of the Burgundian dukes. This period is also remarkable for a reconstruction of the civic government, and for the appearance of the States General, first summoned by Philip the Good. In the states of Holland many nobles sat in person, though they had but one collective vote. At first all towns, larger and smaller, also sent representatives, but after a time the smaller ceased to appear, and only such larger cities as Dort, Haarlem, Leyden, Amsterdam, Gouda, were represented, each having one vote. The president was the "advocatus," or "vogt," of the country, afterward styled "the pensionary," an officer regarded as the champion of the estates against the counts. In Zealand and elsewhere, clergy, nobles and cities sat separately, each order having a single vote. The estates, under the Burgundians, had little power; they could not even control the taxation. Duke Philip in 1464 summoned them to meet him at Bruges, and, though some of the more distant held aloof, the majority obeyed. These States-General, however, expressed no national feeling or union of the provinces; that was a far later state of things.

After Mary of Burgundy had granted the Great Privilege, the provinces warmly supported her against Louis XI.; they approved her union with Maximilian of Austria in August, 1477, though it brought them no rest; for the old parties still survived, and Hooks and Cods fought savagely in almost every town. Maximilian had allied himself with the Cods, and the Hooks were defeated at Leyden and Dort, and finally in their last stronghold, Utrecht, of which city the archduke was made temporal protector in 1483. Before that time (March, 1482), Mary of Burgundy had died, and Maximilian, acting for his son Philip, became governor of the Netherlands. After fresh Hook and Cod troubles at Haarlem, he finally made peace with France in December, 1482, and after the death of Louis XI. brought the Flemings to complete obedience by the peace of Frankfort in 1489. The provinces were still very uneasy, partly through the turbulence of the Hooks, partly because of the autocratic character of his rule, and partly through the so-called "Bread and Cheese" war, caused by famine in the northern provinces. War with France also complicated matters, and the government over the Netherlands was intrusted to Albert of Saxony. In 1494 Maximilian, having been elected emperor, laid down his office as guardian, and had Philip, the Handsome, declared of age. He was at once accepted by Brabant, and the estates of Holland even let him sweep away the Great Privilege. He ruled over them quietly, and got back their English trade. In 1496 he married Joanna of Aragon, daughter of Ferdinand and Isabella, and afterward heiress to the new monarchy of Spain. On Philip's death in 1506, leaving two sons, Charles and Ferdinand, and four daughters, Maximilian again became guardian for his grandson Charles, then but six years old; he named Margaret of Savoy, his daughter, governess of the Netherlands in 1507.

In 1515 Charles was declared of age, and received the homage of Holland and Zealand, Brabant and Flanders, as Count Charles II. In consequence of his friendly relations with Francis I. of France, Henry of Nassau, his comrade and trusted follower, was wedded to Claude, sister of Philibert, prince of Orange, and from this union springs the great house of Orange-Nassau. On his accession to the Spanish and imperial thrones successively, Charles continued his aunt Margaret of Savoy

as governor of the Netherlands, with a privy council to assist her.

He brought all the provinces under one hand, having in 1524 become lord of Friesland by purchase, and in 1528 acquired the temporalities of Utrecht. He now ruled over seventeen provinces, that is, over four duchies—Brabant, Guelderland, Limburg and Luxembourg; seven counties—Flanders, Artois, Hainault, Holland Zealand, Namur, and Zutphen; the margraviate of Antwerp; and five lordships—Friesland, Mechlin, Utrecht, Overijssel, and Groningen, with the Omme-land.

After the death in 1530 of Margaret, who had continued to act for him with her accustomed wisdom and prudence, Charles V. at first treated the provinces with studied moderation; he redressed some of their griefs, reformed the administration and the coinage, issued sumptuary edicts, regulated their commerce, while he also reenacted the severe laws against heresy, and gave full powers to the supreme court of Holland—a body completely under his control. He then appointed his sister Mary, queen of Hungary, regent of the Netherlands. She had at first no easy task; for the provinces had on hand a war with Denmark, and Anabaptist troubles at home; before long also she had to ask for increased supplies; and while the Hollanders granted a large annual subsidy, they refused her a hearth-tax which she demanded. Similar monetary questions in 1539 produced that famous struggle between the court and Ghent, which was only ended by the personal intervention of the emperor; after punishing severely the rebellious burghers, he passed on into Holland, and in 1540, in defiance of the acknowledged rights of the provinces, established a foreigner, René of Chalons, prince of Orange, as stadtholder of Holland, Zealand, and Utrecht. He thus forced on them that great family which has both shed luster on the history of Holland, and defended there and elsewhere the liberties of Europe. René himself ruled but a short time; he perished in France in 1544, leaving his territories to a little cousin, William of Nassau.

In 1545-46 the estates gave the emperor men and money for his war against the Protestant princes of Germany; after Mühlberg, the Netherlands hoped that they might now be freed from the foreign troops Charles had quartered among them. He, however, had other plans on hand, and determined to place permanently in the provinces 4,000 horse, entirely at his own orders. He also laid before the estates in 1548 a scheme of incorporation, which aimed at making the Netherlands an integral portion of the empire, under the name of the circle of Burgundy, and which he abandoned only after the refusal of the seven electors to make Philip king of the Romans. In 1549 he revisited the provinces and called Philip thither also, that they might see their future master; the young prince swore to maintain their rights and customs; and so began between the Netherlands and him the formal relation which under circumstance elsewhere related became so real on October 25, 1555.

After appointing Margaret of Parma, a natural daughter of Charles V., to be regent in the Netherlands, in 1559 Philip set sail for Spain, leaving, in spite of the remonstrances of the estates, 4,000 foreign troops, nominally to protect the frontiers, really to check the independence of the people, and to support the policy of religious persecution which had been resolved on.

But at this moment the long labors of the Council of Trent were ending; and, when in 1565 it finally promulgated its decrees, Philip determined to enforce their acceptance throughout his dominions. Accordingly, he now made a more vehement attack on the Reformers; and then it was that, in 1566, the Netherland nobles, "ed

by count Brederode, signed the famous "Compromise," with which the open rebellion of the provinces begins.

To deprecate Philip's anger at the "Compromise," the council of state sent men of high repute to Spain, where Philip received them kindly, but took good care that they should never again see their homes. Meanwhile he gathered forces with which to suppress the disturbances, which had become very serious. Open-air preachings, guarded by armed men, were taking place throughout the provinces, and raised the excitement to such a height that it at last found vent in iconolastic tumults similar to those of France. This gave the court party only too good an excuse; it could now interpose with authority on behalf of public order. Matters threatened war. The confederacy was in fact broken up; and Margaret saw with satisfaction a considerable body of German mercenaries enter the provinces to inflict punishment, in all its ghastliest and most brutal forms, on the iconoclasts. In 1567 it came to blows; the undisciplined rabble of Calvinists, who tried to raise the siege of Valenciennes, were cut to pieces by the troops of Egmont and other loyal nobles.

In spite of Margaret, who assured Philip that the heretics were completely put down, and their worship abolished, and that consequently there was no need of an army, and that on the contrary the time for mercy had come, the plan for the utter subjugation of the provinces was adhered to, and the duke of Alva, already famous for his harshness and bigotry, was named commander of the forces, with almost unlimited powers. He set forth in May, 1567, and all hopes of peace or mercy fled before him. There was a great and desperate exodus of the inhabitants; thousands took refuge in England, Germany, and Denmark, carrying with them, it was thought, the last relics of their faith and party. The nobles' confederacy had already been broken up; now the popular movement was dispersed, despair and helplessness alone remained to greet the cold Spaniard and his train of orthodox executioners. He entered the Netherlands with about 20,000 men, all tried troops, ready for any cruelties. Their weakness lay in the fact that they were after all mere mercenaries, — Spaniards, Italians, and Germans, — and as such ever ready for a mutiny, if pay fell short, or if there were none to plunder.

The Council of Troubles — the "Blood-tribunal" — was established; Margaret, thrust aside by the imperious general, resigned her weary office, and carried away with her the last hopes of the wretched people. Alva was now appointed governor-general, and the executions of his council filled the land with blood. Though the Gueux under Louis of Nassau won a considerable victory over the Spaniards at Heiligerlee, the arrival of Alva compelled him to raise the siege of Groningen, and to withdraw toward the Ems. At Jemmingen Louis was at last utterly defeated, and though the prince of Orange did his utmost to raise the country, and skillfully avoided a fatal battle, the campaign ended in his being obliged to withdraw out of the country. Alva was now at the highest point of his success; his statue, cast from cannon taken at Jemmingen, was set up at Antwerp; the exodus of the inhabitants continued incessantly, especially to England. The advice of Admiral Coligny, that the provinces should wage war from the sea, was hardly listened to at first. In 1570, however, Orange turned his attention that way, and his little navy, under William de la Marck, annoyed Spanish commerce and took rich prizes. In 1572, being unable to find refuge in any ports, — for neither England, nor Denmark, nor Sweden would allow them harborage, and they were treated not merely as rebels but as pirates, — William de la Marck, with his "Water-Beg-

gars," suddenly seized on Briel, at the mouth of the Meuse, and the face of the struggle began from that moment to change. Alva, partly from the general requirements of his position, partly from lack of funds and desire of his recently-imposed tenth penny, had at this moment driven the Netherlanders to desperation. He was engaged in a struggle with Brussels and Utrecht, in which city, to punish the inhabitants, he had collected his Spanish soldiery from all the neighboring towns. The news of the capture of Briel woke him from his security. Flushing also fell into the hands of the "Water-Beggars," who surprised under its walls a rich convoy from Spain. About the same time, Louis of Nassau, who had been at La Rochelle with the Huguenots, and had received help and encouragement from Charles IX. of France, suddenly seized Mons in Hainault, thus giving the French sympathizers with the revolt the means of entering safely into the Walloon provinces. Alva, now seriously alarmed, withdrew from Zeeland the whole of the forces with which he had intended to check the movement of the "Water-Beggars," in order that he might repair the great breach thus made in his southern system of defense, and so left the province free to develop its resistance. Holland followed quickly, Enkhuizen setting the example; so that, within three months of the capture of Briel, Amsterdam was the only town in Holland in the hands of the Spaniards. In Friesland also the revolt spread far and wide. The states of Holland met, and, acting under advice of Philip of Marnix, lord of St. Aldegonde, the prince's deputy, declared that William of Orange was, by Philip's nomination, stadtholder of Holland, Zeeland and Friesland; they also declared their intention to raise money for the costs of war and the relief of Mons, and affirmed again the liberties of the provinces; finally they named the rough and ready William de la Marck captain-general — a man whose prompt and practical daring would supply the qualities which the caution and apparent irresolution and timidity of William of Orange seemed unlikely to provide for the emergency.

Meanwhile Alva pressed the siege of Mons; French help failed utterly to relieve Louis of Nassau, nor could William of Orange either force his way through the Spanish lines or induce Alva to fight. At this moment came tidings of the massacre of St. Bartholomew, and the prince, seeing that all hope of aid from France was utterly at an end, bade his brother make the best terms he could, and withdrew beyond the Rhine and thence into Holland. Mons at once capitulated, and Alva, passing on to Mechlin, pitilessly sacked that wealthy city. Thence he pressed forward to the north; Zutphen was taken, the towns of Guelderland and Friesland submitted, and for awhile nothing seemed to stay his career of conquest and revenge. The prince of Orange was powerless; but the despair caused by the cruel destruction of Naarden roused a spirit which even Alva could not tame, and the famous siege of Haarlem, lasting through the winter of 1572 till July, 1573, cost 12,000 Spanish troops, and gave the insurgent provinces time to breathe. A great mutiny among Alva's troops still more hindered the work of subjugation. The repulse of Don Frederick of Toledo, Alva's son, from Alkmaar, the capture of Geertruidenberg by the Dutch, and Admiral Dirkson's great victory over Alva's fleet, entirely changed the aspect of affairs, and saved the towns of North Holland. Alva, who had come as far as Amsterdam, returned to Brussels, and thence, obtaining his recall, bade farewell to his government. During the six years it had lasted, his executioners had put to death 18,000 persons, to say nothing of the victims in cities captured by his troops; the Spaniards plundered where they could, and considered the whole wealth of the Netherlands their lawful

prey, forfeited by rebellion. But his pitiless severity only served to raise up a stubbornness of civic resistance, against which the tried discipline of the Spanish soldiery, and the consummate skill of their commander, reckoned to be the first general in Europe, were powerless.

Don Louis of Requesens, grand-commander of Castile, was appointed Alva's successor, and after a brief and deceptive lull the war went on. In January, 1574, by the fall of Middelburg, the Spaniards lost their last hold on Walcheren and on Zeeland, while by the splendid defense of Leyden, unparalleled in the history of heroic endurance, their efforts in another direction were effectually frustrated. After fruitless negotiations with Philip, the estates of Holland, in November, 1574, formally offered to William "the Silent," prince of Orange, full authority by land and sea, with the title of governor or regent. Conferences were also held, with a view to peace, at Breda; and on their failure, in the summer of 1575, Holland and Zeeland drew up articles of union, and an ordinance for their joint government under the prince of Orange. By it he received supreme command in war and absolute authority in all matters of defense, the control of all money voted by the estates, the maintenance of the laws as count, in the king's name, the ultimate appointment (after nomination by the estates) of all judicial officers. He undertook to protect Calvinism, and to suppress "all religion at variance with the gospel," while he forbade all inquisition into private opinions. These terms accepted, William became, in spite of their nominal recognition of Philip, the true prince of the two provinces. Still this union, brought about by the prince's personal character and ability, and by the popular faith in him, was distasteful to the larger cities. Already we may note the beginnings of that party division which was afterward so prominent, and divided Holland between the land-party, popular, quasi-monarchical, Calvinistic, headed by the Orange-Nassau family, and the sea-party, the town-party, headed by the burghers of Amsterdam, Arminian, civic, and aristocratic.

Meanwhile the grand-commander made a successful attempt on the Zeeland coast. His troops took Duiveland, and laid siege to Zierikzee, chief town of Schouwen, and key of the whole coast. The two provinces, unable to relieve the place, were driven to consider their position. So long as they paid any allegiance to Philip of Spain, against whom they were struggling for life, they could never get much help from any other prince, nor were they strong enough to assert their own sovereignty. Three powers lay near them: the empire, already connected with them by old relations, and by the family connection of the house of Orange-France, with her restless Valois dukes, ready for any venture, whether in Poland, England, or Holland; and, lastly, England, whose queen knew well that Philip was her foe, and that the Low Countries might effectually hinder his efforts against her. The provinces, though William had suggested it, refused to deal with the emperor, and turned to Elizabeth; she brought them little real help, and they seemed to be on the very brink of ruin when fever carried Requesens off in March, 1576.

The breathing space thus gained enabled them to strengthen their union under William; but before the question respecting the position of the duke of Anjou could be settled, the siege of Zierikzee drew to an end. Boisot perished in a too gallant attempt to break the leaguer, and the town yielded. Things looked ill for the patriots, and Zeeland would have been at the mercy of the conqueror, had not another great mutiny neutralized the success of the victors; the Spanish and Walloon troops left Zeeland and, headed, as usual, by their

"eletto," marched into the richer plains of Brabant, seizing Alost, whence they threatened both Brussels and Antwerp. One of the results of the panic they caused in Brabant was the capture of Ghent by William. Brussels was only saved from being pillaged by them by the vigor of the inhabitants, who armed in their own defense. Suffering under a powerless administrative, and smarting from the curse of foreign soldiery, the southerners now began to wish for freedom and union with the other provinces. The broad liberality of Orange, moderating the Calvinism of the people, enabled the two groups to draw together. In October, 1576, a congress of the States-General of the provinces met at Ghent; the council of state at Brussels was forcibly dissolved; the frightful "Spanish Fury" at Antwerp struck such terror into all hearts that a treaty was concluded in November, 1576, under the title of the "Pacification of Ghent." It was received with great enthusiasm; in it the provinces agreed first to eject the foreigner, then to meet in States-General and regulate all matters of religion and defense; it was stipulated that nothing should be done against the Catholic religion; the Spanish king's name was still used; the prince of Orange was recognized only as stadtholder of Holland and Zeeland. All the seventeen provinces accepted the Pacification; and for a brief space the "United Provinces" really did exist.

Early in January, 1577, the "Union of Brussels" was put forth. The document engaged all who joined to help in ejecting the foreign troops, in carrying out the Pacification, in maintaining the Catholic faith, in recognizing Philip's sovereignty, in defending the liberties and constitutions of the provinces. It was eagerly adopted; and even Holland and Zeeland made no demur. When the paper, crowded with signatures, was laid before Don John of Austria, who meanwhile had arrived as regent, he also accepted it; and on February 17, 1577, was signed the "Perpetual Edict," which ratified the Pacification of Ghent. Not till the troops were gone should Don John be received as governor-general. Philip II ratified the edict a few weeks later.

Yet, after all, unity did not ensue from it. The natural divergency between north and south at once appeared; in character, in interests, above all, in religion, they had little in common; and when William of Orange refused to publish the edict in Holland and Zeeland he was warmly supported by these provinces. This is perhaps the real point at which Dutch independence begins. Don John entered Brussels in triumph, and, by conciliation and winning manners, had already broken up the union; the whole of the southern provinces withdrew from it at once, and that well-marked difference in political life, which, after so many changes, still distinguishes Belgian from Dutchman, was from that moment made clear. Yet, though Don John had achieved so much, the result, after all, disappointed him; he was surrounded by difficulties, suspicions and plots; he saw the failure of his larger schemes, and only the partial success of his effort to reduce the Netherlands; he recognized the dangers which the abilities and rivalry of William of Orange were preparing for him. This was soon shown in the seizure of Antwerp citadel by the patriots, and in the destruction of the hated fortifications, so long the sign and efficient cause of their subjection. Other castles, such as that of Ghent, were razed to the ground as soon as the fall of Antwerp citadel was known. Still less was Don John pleased by the election of his rival as *ruwaard* of Brabant, and by his enthusiastic reception at Brussels. The States-General (December 7, 1577), declared strongly against Don John's authority.

It was clear war must begin again; and the patriots raised an army nearly 20,000 strong, which was utterly

defeated by Don John and Alexander Farnese, at Gembloux near Namur. But their campaign was wasted on isolated movements and town-taking, while William of Orange fell back unmolested to Antwerp. A sudden illness, so sudden as to arouse the common suspicion of poison, carried off the conqueror of Lepanto (October 1, 1578), and Alexander of Parma succeeded him in the government.

The struggle had now entirely passed into the southern provinces; Holland and Zealand were left to gather strength; the recovery of Amsterdam (1578) removed the one hindrance to their prosperity. While the south trusted to foreign help, some John Casimir, or duke of Anjou, the north quietly consolidated itself. In January, 1579, was proclaimed the famous "Union of Utrecht." The document professed to make no changes; it would but carry out the Pacification of Ghent by a closer junction of Holland and Zealand with Friesland, Guelderland with Zutphen, Utrecht, Overijssel, Groningen; united as one, these provinces should still retain their local uses and privileges. So long as the archduke Matthias, who had been appointed governor-general in 1577, remained, his authority would be respected; on his withdrawal in 1580 the States-General named as stadtholder William of Orange, who had already exercised the real authority over the provinces. A considerable number of southern cities, Ghent, Antwerp, Bruges and others, as well as some of the nobles, also joined this union. Thus did the United Provinces at last come definitely into being.

During the next five years Spain devoted her efforts to the southern provinces alone; the union was unmolested. The Walloon provinces were reconciled to Spain; the others, with the exception of Holland and Zealand, had accepted the duke of Anjou as their sovereign; Holland and Zealand had proclaimed William of Orange as their chief, though he did not finally accept sovereign power and the title of count till August, 1582; by a sort of cross-division, the seven northern provinces, meeting at the Hague, had (July 26, 1581) made an "Act of Abjuration," and had issued their "Declaration of Independence," the five naming Anjou, the two William, as their sovereign in Philip's stead. Then Holland and Zealand framed an independent constitution, conservative of their ancient liberties, as expressed in the "Great Privilege of the Lady Mary;" they declared themselves a free country, severed alike from Spain and from the empire.

But Spain was not yet ready to take up this challenge; and, meanwhile, she resorted to other weapons. A scandalous proclamation, offering rewards and honors to any ruffian who would serve church and king by murdering William of Orange, was now issued; and, roused by the double inducement, after many unsuccessful attempts, a paltry wretch (July 10, 1584) succeeded in assassinating the greatest man of his age, the worthy "Father William" of the Dutch, and the only ruler in the world's history who may be fairly compared with Washington.

Fortunately for the Provinces and for the world's liberties, the spirit of William of Orange survived in his second son Maurice, who now, though he was only seventeen and a student at Leyden, and though he had an elder brother living in Spain, was at once, chiefly through the influence of that great statesman, John Olden Barneveldt, named governor of the United Provinces, with a council of state, and with Count Hohenlohe, his brother-in-law, as lieutenant-general. He was also, soon after, made stadtholder of Holland and Zealand, while Utrecht was placed under the lord of Villars as stadtholder, Guelderland and Overijssel under the count of Meurs, and Friesland under William of

Nassau. Never was anyone better fitted for his life's task than was this boy, thus early called to rule in troubled times. For Maurice of Nassau had all the coldness and calculation of his family, all its ambition, all its firmness and tenacity of grasp, while he added thereto a quality wanting in the others, a genius for war, and those gifts which go to make what is commonly called a lucky commander — gifts which may be best described by saying that the lucky captain is he who in war leaves least to luck. For over forty years Maurice was the champion of the provinces; and, if we except his treatment of Barneveldt, we may say that he comes next after his father as a founder of the Dutch republic.

At the outset his antagonist was that formidable captain, Alexander Farnese, who had by this time nearly subdued all the southern Provinces, and whose arms proved successful at Ghent (1584) and at Antwerp (1585). The northern provinces, thinking it necessary to call in foreign aid, appealed to Henry III. of France, but the outburst of the "War of the three Henries," caused by the anxiety of the Guises lest Henry should draw too much toward the heretics, put a stop to all hope of help from that side. Olden Barneveldt, therefore, next crossed over to England with offers to Queen Elizabeth, who, though declining for herself the proffered sovereignty over the Provinces, undertook to appoint a governor-general, and to send over and pay 5,000 foot and 1,000 horse; in return for which she was to be put in possession of certain cautionary towns. Accordingly, Sir John Norris was at once sent over with the English forces; Sir Philip Sidney was appointed governor of Flushing, and the earl of Leicester was named governor-general by the queen. At first Leicester was welcomed with all the joy that his Calvinistic opinions, and his position as favorite and representative of Elizabeth, could elicit in the breasts of men who had now long been struggling for existence, and who, bereft of their great prince, were yearning for some strong hand to guide them. But it did not last; his high pretensions and his mistress' haughty tone, joined with his foolish interference with Dutch commerce and with the religious difficulties now beginning to show themselves, soon offended the States-General, and neutralized whatever good the active help of England might have promised them. In 1586 Sir Philip Sidney invaded Flanders, and the young stadtholder of Holland gladly served under him. In the same autumn Leicester himself took the field, and marched to meet Parma, who was threatening the provinces from the east. Under the walls of Zutphen Sir Philip Sidney fell; and Leicester, finding his efforts useless, soon raised the siege of that town, and withdrew to the Hague. The rest of his time was spent in bitter quarrels with the estates; Olden Barneveldt and Maurice were united for a time by his marked ill-will toward them both; and so strong did the feeling against him grow, that, in 1587, Queen Elizabeth was fain to order his recall. For a while there was great soreness between the countries; the general interest, however, was far stronger than any partial pique, and in the crisis of the Spanish Armada in 1588 the Dutch did very great service to England by resolutely blockading in their ports the transports and army with which Parma had meant to invade the English shores. In the same year Maurice had the satisfaction of seeing the English and Dutch repulse the famous duke from the walls of Bergen-op-Zoom. In 1589, on the other hand, the English garrison of Geertruidenberg betrayed that important place, the doorway out of Brabant into Holland, into Parma's hands, and laid the United Provinces open to attack. In other places also the English forces, not yet withdrawn, were an anxiety and danger to the States. Still.

from this moment the fortunes of the Dutch began to rise.

The year 1590 opened well for the United Provinces; Utrecht joined its fortunes with those of Holland and Zealand; Guelderland and Overijssel made William Louis of Nassau their stadtholder, so strengthening the power of the family; and Breda was recovered by a daring stratagem. The duke of Parma also, with failing health, was called away to oppose the victorious progress of Henry IV. in northern France. In 1591 Prince Maurice still further strengthened himself by taking Zutphen, Deventer, Hulst, and eventually Nimeguen, which secured for him the complete submission of Guelderland. Parma was unable to oppose him effectually, for his troops were again mutinous; he was also once more called off into France. The reputation of Prince Maurice rose now to its highest point; the greatest captain in Europe seemed unable to cope with him, and the vigorous help of Barneveldt still secured him firm support at home. In 1593 he took Geertruidenberg; and in 1594 Groningen, the only stronghold left to the Spaniards in all the Seven Provinces, was reduced.

The appointment of the cardinal archduke Albert as governor of the Spanish Netherlands did not much change the current of affairs; the Dutch now tried to open up a trade with the East Indies, and made some vigorous explorations in Arctic seas. In 1596 the archduke recovered Hulst, which commanded the northernmost parts of Flanders; the Dutch, on the other hand, with the English, sacked Cadiz and destroyed the Spanish fleet; and in the next year Maurice inflicted a defeat on the Spaniards at Turnhout, transferred his sphere of action to the Rhine country, and took town after town, making the provinces secure on the side of Zutphen, Overijssel and Friesland. The year 1598 gave a new aspect to affairs by the conclusion of the Franco-Spanish war in the treaty of Vervins, and by the death of Philip II. The Dutch, assisted only by the English, and that chiefly by volunteers, were now to bear the whole brunt of the efforts of Spain. In the autumn of 1599 Prince Maurice endeavored to transfer the war into Germany; and after taking Emmerich in the Cleves country, delivered Bommel from the siege which Mendoza, the Spanish general, was laying to it. But dissatisfaction at home, and the unreadiness of his German allies, forced Maurice to turn his eyes toward Flanders, which he invaded in the summer of 1600. Surprised by the Spaniards in the neighborhood of Nieuport, Maurice was attacked by the Archduke Albert in a most critical position, but, after a long and well-balanced battle, inflicted on him (July 2d) a disastrous defeat. Maurice could not, however, take the town, and winter put a stop to the campaign without any great change in the relative position of the belligerents. In 1601 the archduke began the famous siege of Ostend, which lasted three years and two months; the losses on both sides, more especially among the Spaniards, were immense. While it continued, the coolness between the States-General and Maurice steadily increased; for they thought his cold, ambitious nature capable of anything, and saw with fear the paramount influence he had over the army. Their instincts led them to rest on the ships, to prefer peace to war, and commerce to glory. It was during the siege of Ostend that they established the Dutch East India Company in 1602, though its basis had been laid down by a group of Amsterdam traders in 1595.

In 1604 Maurice took Sluis, and Ostend at last fell to Spinola. Thenceforward the main lines of the struggle by land were simple enough; the Spaniards tried to transfer the seat of war into the United Provinces, and

were steadily foiled by Maurice. All the while the States-General aimed at peace, though the naval war became vigorous as that on the land languished. The sea fight off Gibraltar in 1607 utterly ruined the Spanish fleet, and left her commerce powerless. At last, after long negotiations, which served to emphasize the variance between the patriot party, headed by Barneveldt and Grotius, and the war party, which included the official classes, the army, navy, East India Company, the clergy, and the populace in the towns, a truce for twelve years was signed, on the *uti possidetis* ground, between Spain and Holland. In the war the Dutch had added Overijssel and Groningen to the union; they held Sluis, Hulst, and other ports on the Flemish side, in what is called "Dutch Flanders;" they had Bergen-op-Zoom, Breda, and Herzogenbusch on the Brabant frontier, and the forts which commanded the Scheldt and strangled Antwerp for the sake of Amsterdam; lastly, they were become lords of the sea, and the chief traders of the world.

After a brief interference in the affairs of Germany, where the intricate question of the Cleves-Juliers succession was already preparing the way for the Thirty Years' War, Holland settled down into that hot and absorbing theological struggle, which was closely mixed up with political questions, and which stained with a deplorable triumph the last years of the career of Maurice of Nassau. In 1603 Jacob van Hermansen, or, in Latin form, Arminius, had been appointed one of the two professors of theology at Leyden, Francis Gomarus being the other. The two men took opposite sides with zeal, Arminius assailing and Gomarus defending the current popular theology. The views of Arminius spread fast among the upper classes, especially in the larger towns, and became the theology of the civic aristocracy; the established opinions were tenaciously supported by the bulk of the clergy, the peasantry, the town populace, the army, and the navy. At their head stood Maurice, ready to use the strength of Calvinistic feeling to secure his own authority, however little he might care for the tenets of his side; at the head of the other party, more philosophical, less in earnest, perhaps, was Barneveldt, with the town traders. King James of England as yet supported the Calvinists, and with Archbishop Abbot influenced greatly the proceedings of the famous synod of Dort (1618) in favor of Prince Maurice and the anti-Remonstrants. The result of the synod enabled the prince, for his own political purposes, to crush the aristocratic party. Barneveldt and Grotius (another leading Remonstrant) were seized, and in spite of all his great service to his country, his venerable age, and his past support of Maurice, the pensionary was brought to an infamous trial and executed at the Hague in 1619. Grotius afterward escaped from prison and took refuge in France. The silenced Remonstrants, finding that there was no hope of toleration for them, left the country in great numbers, and formed a prosperous settlement in Holstein, in 1621, where they founded the town of Frederickstadt on the Eider.

In 1621 the truce with Spain came to an end, and the Dutch were at once involved in the vortex of the Thirty Years' War, which had now been going on for a couple of years. Spinola, after taking Juliers, attempted Bergen-op-Zoom, hoping thereby to open a passage into Zealand; he was, however, foiled by Maurice. About this time a great coolness sprang up between Holland and England, the beginning of the deadly rivalry which lasted so long. King James was eager to gain his objects without fighting, and to be on friendly terms with Spain; he and Laud were opposed to the Calvinism of the Dutch, and disliked their form of church government; and commercial jealousy was already beginning to arise. Suc-

cesses and losses were evenly balanced in the war: the Dutch recaptured Juliers and took Cleves, while Spinola, after great losses caused by the gallant defense of the English, in 1625 took Breda. A few days before the town fell, Maurice died, leaving the Spaniards in the heart of his territories, and the Dutch vexed with religious and domestic factions.

His brother, Frederick Henry, of Orange-Nassau, succeeded him as stadtholder of Holland, Zealand, Guelderland, Utrecht and Overijssel. The war by land became utterly spiritless, though by sea the Dutch still asserted their maritime supremacy. By land the chief operations were the siege and capture by Frederick Henry of Herzogenbusch, Maestricht and Wesel in 1628; by sea the Dutch interfered, much against the popular feeling, to assist the French court against the Huguenots at La Rochelle. They blockaded Dunkirk, whence Spanish privateers had been wont to harass their commerce; under Piet Heyn, of Delfshaven, boldest of their sea-captains, they vexed the Spanish coasts, captured Spanish war ships, carried off their "silver fleet," and, finally, in 1631, won, near Tholen, a brilliant victory over a great Spanish fleet commanded by Count John, of Nassau, who was endeavoring to make a descent on the Zealand coast.

In this year the States, feeling that the moderation of the stadtholder was honest and salutary, that his influence alone seemed able to quiet the rage of religious faction, and that his military operations had secured the confidence of the provinces, took the important, and, as it turned out, the unwise step of securing to his infant son the reversion of all his great offices of stadtholder, captain and admiral-general. The Calvinists were willing to grant so much to the head of their party, and made no objection to the introduction of the principle of hereditary succession; while the Remonstrants, discerning that Frederick Henry, like his brother before him, was personally more favorable to their tenets than to those of their adversaries, accepted the measure in the hope that when permanently established as their prince, he would carry out those tolerant views which he was known to hold.

In 1632 he justified their confidence by his masterly siege and capture of Maestricht, in defiance of all the efforts of the Spanish and imperial generals; Namur, Luxembourg, and eastern Brabant were laid under contribution in consequence, and the States defended from danger of attack toward the east. As the war dragged on after the death of Gustavus Adolphus of Sweden, France and Holland drew more together, and 1635 an alliance and partition treaty was made between them, in which it was proposed that the Spaniards should be driven out of the Netherlands, which should be made an independent state, guaranteed by the allies; that France should receive, as her share, the seacoast up to Blankenberg, together with Thionville and Namur; and that a corresponding portion should be given to Holland; if this scheme of an independent state proved a failure, then France and Holland should divide the whole district between them. The joint operations consequent on this agreement proved a failure; Frederick Henry had always been opposed to the alliance, and probably did not wish it success; the divergence between him and the States-General at this time gave Cardinal Richelieu the opportunity of restoring the Remonstrant party to Holland, and making it French in sympathy, in opposition to the House of Orange—a combination of which Louis XIV. afterward made great use. In 1637 the stadtholder recovered Breda, though the gain was balanced by the loss of Roermond and other places; and in 1638 the war was favorable to the Spaniards. In 1639, however, a series of great naval triumphs

under Tromp and De Witt turned the scale in favor of the Dutch.

In 1640, on the death of Count Henry of Nassau, stadtholder of Friesland and Groningen, the latter province chose Frederick Henry as its stadtholder, and he thus became chief of six out of the seven United Provinces; in the next year he was able to arrange the marriage of his son William with Mary, eldest daughter of Charles I. of England, a match devised by the queen-mother of France, while a refugee in Holland, in order to increase the ill-will between Richelieu and the stadtholder. Thus began the dynastic relation between the Stuarts and the house of Orange, which led to such great results before the end of the century. The States-General were not too well pleased with this alliance, and looked shyly at Henrietta Maria when she came over to Holland to get help for Charles I. in 1642. They were becoming alarmed at the great power and ambition of France under Richelieu, while they sympathized to a great extent with the English Puritans.

All parties, except the French, being now utterly weary of the war, negotiations for peace, long talked of, long prepared for, began in earnest at Münster and Osnabrück. Before their close Frederick Henry died in 1647, and was succeeded in his dignities and offices by his young son William II., and almost immediately afterward (January, 1648), in spite of the opposition of France and the young prince of Orange, the deputies of the Provinces (with exception of Zealand and Utrecht) signed a separate treaty of peace with Spain, which was confirmed and sworn to in May at Münster. It was a complete surrender of everything for which Spain so long had fought. The United Provinces were recognized as free and independent, and Spain dropped all her claims; the *uti possidetis* basis was adopted in the matter of all conquests; the two contracting parties agreed to respect and keep clear of each other's trading-grounds; each should pay, in the ports of the other, only such tolls as natives of the other paid; the Scheldt was entirely closed by the States, so that Amsterdam might strangle Antwerp—the chief harbor of the free Provinces—thus ruining the chief harbor of those still subject to Spain. And so ended the so-called Eighty Years' War.

No sooner was the peace concluded than bitter disputes arose between Holland, on the one hand, and the prince of Orange, supported by the army and navy and the smaller provinces, on the other. He was tempted into foolish acts: he arrested six of the deputies of Holland, he even tried to surprise and occupy Amsterdam; he favored the English royalists, now plentiful in the Provinces, while Amsterdam and Holland inclined toward the Commonwealth. Things went so far that William II. had almost destroyed the liberties of the Provinces, and was intent on two schemes—the resumption of war against Spain, with a partition with France of the Spanish Netherlands, and interference on behalf of Charles II. in England—when his opportune death by small-pox occurred. A few days afterward his widow, Mary of England, gave birth to a son, who was destined to be the most distinguished man of his race, William III. of Holland and England.

For a time the death of William II. restored the burgher-party to power, and made Amsterdam the head of the United Provinces. Holland triumphed over Zealand; the house of Orange, friend of the Stuarts, seemed to suffer eclipse with them; and though the royalist mob even at the Hague, set on by a princely rough of the palatine house, made it impossible for the envoys of the English Commonwealth to come to terms with the republic, still the popular monarchical party

was in fact powerless in the Provinces for more than twenty years. It was with a view to the security of this aristocratic government that a great assembly of the Provinces was held in 1651, and established that form of rule which Sir William Temple has so well described in his *Observations upon the United Provinces of the Netherlands*.

There were four chief elements in that federation:—the terms of the Union of Utrecht (1579); the claims and position of the house of Orange; the sovereignty, within its own borders, of each province; and lastly, the liberties and power of the cities. In the last two the lead was taken by Holland: Holland was the chief province, and Amsterdam, its capital, the chief city of the union. And these two parts of the federation were at one also in their resistance to the house of Orange, of which the chief strength lay in Zeeland. The union was governed, in theory at least, by the States-General of the provinces, which met at the Hague, and consisted of a fluctuating number of deputies (sometimes as many as 800), and was supplemented by a permanent council of state, a kind of cabinet composed of twelve deputies from the provinces, and a chamber of accounts. Besides this body each province had its own estates, and each great city its own senate. Thus Amsterdam was ruled by a senate of thirty-six burghers, who kept order, administered justice, and raised local taxes. The office of senator was for life, originally by election of the whole body of freemen, but from the sixteenth century by coöptation, so that the government of the city became a close oligarchy. The chief towns followed Amsterdam in this direction. The senate elected the deputies of the city to the states of Holland.

At first William the Silent had been governor of the Provinces, nominally at least under the king of Spain; and in the reconstruction he secured his own rights, while the sovereign power was transferred to the States General. They took the right of making peace and war, of concluding alliances, of taxing and coining. The governor had all military commands, had power to pardon, and controlled the civil appointments; he represented the dignity of the state, with a court and guards, and envoys from other lands. Each province had its own stadtholder, an office in name at least derived from the Spanish times; each town had its own pensionary or chief minister. But after the death of William II., the office of Stadtholder of Holland was for a time suspended; there was no captain-general or admiral; and the grand pensionary of Holland, first minister of the state, became virtual president of the republic, as we see in the case of John de Witt and Heinsius.

When the English envoys returned to tell their masters, the Commonwealth, of their failure at the Hague, parliament at once replied by passing the memorable Navigation Act of 1651, which aimed at destroying the carrying trade of the Provinces. The struggle for the lordship of the seas which ensued, and with which the names of Tromp and Ruyter, Blake, and Monk are so splendidly associated, was waged with equal bravery and nearly equal success on both sides, until 1654, when peace was made by the Amsterdam burgher-party. By the terms of the treaty with Cromwell the Orange-Nassau family was altogether to be excluded from the stadtholderate of Holland, the other Provinces reserving their independence, and the Dutch populace also much disliking the peace. England preserved the honor of her flag, while Holland was seen to be a worthy and equal rival for the command of the sea.

Hostilities between the Dutch and Portuguese respecting their rights in Brazil followed, in which, after each side had done much damage to the other, peace was also made; and Holland in 1658 interfered to save the Danes

from Charles Gustavus of Sweden. In 1659 a treaty of peace was made between France, England, and the United Provinces, with a view to the settlement of the Dano-Swedish question, which ended in securing a northern peace in 1660, and in keeping the Baltic waters open for Dutch trade. Since the abolition of the stadtholderate after William's death in 1650, the center of authority had lain in the hands of John de Witt, the sagacious leader of the anti-Orange or Amsterdam burgher-party; and he guided the foreign affairs of the provinces in such a way as to secure the fair development of their commerce on every side.

The momentous year 1660 was almost as critical for Holland as for any state of Europe. Charles, in England, having reënacted the Navigation Act, war again broke out in 1665, and the duke of York took the command of the English fleet. At the beginning of June he met the Dutch admiral, Opdam, and, after a close-fought battle off Lowestoft, the English were completely victorious. But, so bad was the condition of the home government in England, that in the following year, the Dutch had by far the stronger fleet at sea, and for a time held their own in the Channel. The four days' battle (June 1-4), between Prince Rupert and Monk on the one side, and Ruyter on the other, ended in an uncertain victory for the Dutch; but on July 25th they were decidedly defeated off the North Foreland, and driven back to their own shores with immense loss. The English were now masters of the sea; but both parties needed peace, and negotiations began at Breda. In the course of these, Ruyter suddenly sailed up the Thames, nearly to Gravesend, and struck terror into the very heart of London, which thus became all the more eager for a settlement. In July, 1667, a treaty between England and Holland was signed at Breda; and in the following year Sir William Temple accomplished the triple alliance of England, Holland, and Sweden, against the aggressive views of Louis XIV., a hollow affair, and pernicious in its results to those who made it. It made Louis XIV. determine to take vengeance on the United Provinces and on the De Witts; it led at once to the humiliation of England by the treaty of Dover (1670), to the overthrow of the Amsterdam party, and to the miserable end of the De Witts; and it eventually raised the prince of Orange to supreme authority in the United Provinces.

From 1668 to 1672 Louis XIV. made ready to destroy the Dutch; and so well had his diplomacy served him that they were left without a friend in Europe. In 1672 the storm broke: the English, without a declaration of war, tried unsuccessfully to intercept the Dutch Mediterranean fleet; and France at once set forth to conquer the hated tradesmen of the north. The States were ill-prepared on land, though their fleet was strong and ready; party spirit was exceedingly bitter, and the ruling party, well aware that the prince of Orange was very popular with the land forces, had utterly neglected their army. On May 28, 1672, Ruyter fought a great naval battle in Southwold Bay (Solebay) against the duke of York and Marshal D'Estrées: the French held aloof, pleased to see the Dutch and English destroy each other; the English suffered most, but as the Dutch withdrew to their own ports, the others claimed the victory. Meanwhile Louis XIV. crossed the Rhine and threatened Amsterdam (see FRANCE). The young prince of Orange alone seemed to rise to the occasion; while others were panic-stricken, sending embassies of submission to the haughty monarch, making preparations for a great flight by sea, William with his miserable army did his best, and aroused so strongly the feelings of the people that Amsterdam, passing from dejection to despair and thence to reckless enthusiasm,

rose against the De Witts and foully murdered both in the streets. They had just before proclaimed William stadtholder of Holland with powers unlimited. And thus Louis XIV. destroyed the proud republic, though in so doing he had raised up the most formidable enemy he was destined to encounter. His invasion did not prosper; other nations began to take up the Dutch cause; Germans and Spaniards threatened the embarrassed French army in the Provinces; so that in 1674 France was on the defensive on every side. William of Orange in that year was defeated at Senef, and had to abandon his plan of penetrating into France, and in 1675 the death of Marshal Turenne, and the retirement of the great Condé, turned the tide of war in favor of the Dutch, except on the sea, where the French fleet defeated and destroyed in the Mediterranean (in 1676) the united navies of Holland and Spain. In 1677 negotiations for peace went on, and were hastened by the marriage, at the close of the year, of William of Orange with the Princess Mary, daughter of the duke of York. At last, in 1678, came the great peace of Nimeguen, which secured the independence of the Dutch.

The aggressive policy of Louis XIV., in the years which followed the peace of Nimeguen, enabled William to lay the basis of the famous confederacy which changed the whole front of European politics. Brandenburg, Denmark, and England sided with the French king; while the league of Augsburg (1686), following directly after the revocation of the edict of Nantes, placed William at the head of the resistance to French domination. The league was joined by the emperor, Spain, the United Provinces, Sweden, Bavaria, and other German princes. The accession of James II. to the throne of England made it easy for the stadtholder to keep up close relations with the malcontents in church and state, who regarded him and the Princess Mary as the natural successors to the English throne. On the birth of the prince of Wales the anti-Catholic feeling in England at last grew so strong that William was able to interfere with success; while the diversion of the attention of Louis XIV. from Holland to the Rhine relieved the timid rulers of Amsterdam from all anxiety. The Revolution of 1688 ensued, and England became, under William's strong rule, the chief member of the great coalition against France. In the grand alliance of 1689-90, he clearly sacrificed Dutch to English interests, and carried through his policy in spite of great irritation in Holland and Zealand. His power seemed almost autocratic, and the States impotent. Henceforward their part in history becomes quite secondary compared with that of England, and we may refer for details of the great wars to the articles ENGLAND and FRANCE.

In 1690, Waldeck, commanding the Dutch, was defeated by Luxembourg at Fleurus; and the Anglo-Dutch fleet was also severely handled off Beachy Head by the French, who inflicted terrible losses on Dutch commerce. In 1691 the French took Mons; in 1692 the allied ships ruined Tourville's fleet off La Hogue, and recovered the command of the sea. On land the allies fared ill; Louis took Namur, and after a hard-fought battle William was defeated at Steenkirk; in 1693 the Dutch shared in the defeat of Neerwinden, and were not fortunate even on the sea. In 1695 the tide of affairs had turned, and William retook Namur, his greatest triumph after the battle of the Boyne. Negotiations for peace, first attempted in 1694, led to the peace of Ryswick in 1697, in which William was recognized by France as king of England, the Dutch obtaining a favorable commercial treaty, and the right to garrison the Netherland barrier-towns. Holland was still an important factor in the balancing system, rendered

necessary by the ambition of France. Louis XIV., however, held himself little bound by the peace. In 1701 he elbowed the Dutch troops out of the barrier-towns; he defied England by recognizing James III. on the death of his father; and it was clear to all that another war was imminent, when William III. died in 1702. He had been made hereditary stadtholder in five of the Provinces in 1672; but as he left no children as heirs, the old opposition of Holland to his house again sprang up, and, led by the grand pensionary Heinsius, Amsterdam successfully asserted her independence, and ruled throughout the coming struggle against France with energy and credit.

When war was declared in 1702, Marlborough was named commander-in-chief of English and Dutch troops, and thenceforward became the chief man in the famous "triumvirate" of Marlborough, Heinsius and Prince Eugene. In 1703 the Dutch invaded Flanders, and fought the drawn battle of Eckeren; in 1704 they and the English took Gibraltar; in the same year they took part in the great battle of Blenheim. In 1705 Marlborough led them into the Netherlands; but, hampered by the deputies of the States, he achieved little. In 1706 he won the battle of Ramillies, and swept the French out of the Netherlands; in 1708 came Oudenarde, and after it an unsuccessful attempt of Louis XIV. to detach the Dutch from the alliance; in 1709 the terrible battle of Malplaquet and the capture of Mons. After this great changes followed in England, and Marlborough's power came to an end. Negotiations for peace, often tried before, drew toward success in 1712, and in 1713 the peace of Utrecht was signed. While France received Aire, St. Venant, Bethune and Douay, the Spanish Netherlands were formally handed over to the United Provinces, which, in their turn passed them on, after conclusion of a barrier treaty, to Austria; henceforth they are known as the Austrian Netherlands. A favorable commercial treaty was also made between the Dutch and France. The peace of Utrecht made the republic almost as powerful on shore as she had been by sea; at the same time it taught her that the great powers around her would use her resources for war, and abandon her when they wanted peace; she, therefore, determined henceforth to stand clear of all foreign complications. With 1713 the importance of Holland in European politics comes almost to an end.

The ruling party in the States took an active part in securing George I. on the throne of England; and on the death of Louis XIV. in 1715, the old ill-will between France and the provinces died entirely out, so that they were secure in a position of tranquillity; they also brought to a fair conclusion their difficulties with Austria on the subject of the Netherlands barrier. These, however, began again when in 1723 the emperor set on foot the Ostend East India Company, which was at once regarded as an offensive rival by the Amsterdam merchants. For the sake of crushing this competition the States in 1731 consented to guarantee the Pragmatic Sanction of Charles VI. In 1743 they joined England in supporting the claims of Maria Theresa, queen of Hungary, and fell consequently into complications with France, which invaded the barrier country. In 1744 they granted a subsidy in money and put 20,000 men in the field, and became a member of the Quadruple Alliance with Austria, England and Saxony. In 1745 the Provinces took their part in the rout of Fontenoy, after which Marshal Saxe overran the Austrian Netherlands, while England and Holland were alike paralyzed by the Jacobite rising in Scotland. The States lost every barrier-town, and lay defenseless before the French, who in 1747 entered Dutch Flanders, and made an easy

conquest. And now the Orange party, supported by English aid, began to lift its head. The Provinces had fallen so low that all men began to wish for a dictator. Accordingly Prince William Charles Henry Friso was proclaimed stadtholder, captain, and admiral-general of Zeeland at Terveer, under the title of William IV. The movement thus begun spread like wildfire; all Zeeland accepted him with enthusiasm, and Holland was not far behind; even at Amsterdam and the Hague the popular feeling was too strong to be resisted, and the government had to give way. William IV. became captain and admiral-general of the whole union, and stadtholder of the Seven Provinces: a little later these offices were declared hereditary in both male and female lines.

The peace of Aix-la-Chapelle, in 1748, though it nominally restored things to their old estate, could not efface the mischief and humiliation which the war had caused to Holland. Nor were affairs mended by the death of the stadtholder William IV. in 1751, who, though dull and quiet, did his best to develop the commercial and manufacturing prosperity of the States. His widow, Anne of England, daughter of George II., carried on the government for her son William V. She showed but little aptitude for the post of regent, and the Provinces had great difficulty in keeping clear of the European complications of the Seven Years' War. They did so, however, and after her death in 1759 were on better terms with England, which had urged them to take up the cause of Frederick the Great. In 1766 William V. was declared to be of age; irresolute and weak, he was entirely under the command of his old preceptor Louis of Brunswick, and his wife Frederica Wilhelmina, niece of Frederick the Great. His rule is only distinguished for the springing up of several learned societies, and for the stimulus, derived partly from England partly from France, given to scientific inquiries. In other respects the influences of England and France were not propitious to the Provinces. In the American War of Independence William sympathized with the English court against the French and the revolted colonies, while the Dutch people warmly embraced the other side. Hence arose again old maritime disputes. The Provinces quarreled at home over the relative importance of army and navy, and strengthened neither. So things went on from 1776 to 1780, when the famous "Armed Neutrality," with which the Continental states replied to the demands of England on the seas, drew the provinces once more into the arena of European politics. After a division of the States, in which four were on one side and three on the other, the United Provinces decided to adopt the Neutrality, and threw in their lot with France and Russia against England. But though war broke out at once, nothing could cure the violence of party spirit—the stadtholder and the court party going with the English, and neutralizing all the warlike efforts of the "patriot" party. In 1781 Dutch commerce was utterly paralyzed; the other powers set on the Provinces, and took each its part. Their West India Islands were seized, and it seemed as if they could do nothing in their own defense. At last, however, an indecisive but not inglorious action with Admiral Parker at the Dogger Bank roused the national spirit, and the Orange party lost ground everywhere. In 1782 the Provinces recognized the independence of the United States of America; with generous sympathy the aged commonwealth saluted the rising republic of the West, which was destined to take its share also in the ruin of Dutch trade. In 1783 the States made an inglorious peace with England, in which the English got the right of free traffic with the Dutch East India colonies.

The patriot party was so much excited by this long series of blunders and humiliations that the fall of the house of Orange seemed imminent, and the king of Prussia had to interfere on behalf of his kinsfolk. In 1784 the States were in trouble with a new antagonist; the emperor Joseph II. sought to compel them to acquiesce in the reopening of the mouths of the Scheldt, so as to restore some of its ancient prosperity to Antwerp. But as neither party was able to fight, a peace was patched up in 1785, though its terms as usual were very humiliating to the States. The resistance against the princess of Orange continued to increase in violence, until in 1787 the Prussians again interfered, occupying Amsterdam, reinstating the stadtholder, who had been driven out, and compelling the States to ally themselves, much against their will, with England and Prussia.

Under their sway the Dutch passively remained, and when the French Revolution came they stood neutral as long as they could between it and the kings; it was not till Dumouriez had overrun all the Austrian Netherlands in 1792, and had determined to secure justice to Antwerp by forcing open the passage of the Scheldt, that they were drawn into the strife. On the death of Louis XVI. in 1793 the national convention at once declared war against both England and the Provinces. Their first campaign against the Dutch under Dumouriez failed; the invaders were arrested before Willemstadt, and ultimately were compelled to retreat. But in the autumn of 1793 Jourdan restored the credit of the French arms in the Austrian Netherlands. In 1794 Pichegru brilliantly completed the conquest of Belgium, and before the end of the year invaded the Provinces. The very severe frost of that winter gave his army easy passage over all the rivers and low-lying lands, which still formed the chief defense of the states; he occupied Amsterdam, and with his hussars crossed the ice and took the Dutch fleet as it lay at the Texel: the stadtholder fled (1795) to England; and the shattered remains of the duke of York's army having reached Bremen returned home in disgrace. The Republican party in the Provinces now reorganized the government so as to bring it into close harmony with that of Paris. A new constitution was framed; the ancient system of representative government, the stadtholderate, and the offices of captain and admiral-general were all swept away; a fair and open representation was established; and the Batavian republic came into being in close alliance with France. The French with one hand delivered the Provinces from a worn-out system of government, and with the other seized on a substantial return for their assistance. The new constitution, so excellent in appearance, soon proved a delusion. One change of government succeeded another; after the States-General came a national convention; then in 1798 a constituent assembly with an executive directory; then chambers of representatives; then a return to the earlier system under the names of the eight provincial and one central commissions (1801).

The peace of Amiens gave the country a little rest, and the Dutch got back the Cape of Good Hope and their South American colonies; it was, however, but the brief and deceptive lull between two storms; when war began again England once more swept away all she had restored. In 1805 Bonaparte, with his usual high hand, imposed on them a new constitution, and set Schimmelpenninck over them with the ancient title of grand pensionary. In the next year Napoleon added Holland to the ring of great fiefs with which he surrounded his imperial system, and forced an unwilling brother, Louis, to be king of an unwilling people. Worthy of a better fate, the excellent king of Holland did all in his power to protect his new subjects from the crushing friendship of his brother; but his efforts were

in vain, and he withdrew to Vienna. In 1810 Napoleon annexed all Holland to the empire, declaring that it was "in the nature of things nothing but a portion of France." In 1813 the change in the affairs of Europe encouraged the Dutch to join the general revolt, when they established a limited monarchy. The prince of Orange was recalled from England, and entered Amsterdam amidst the utmost enthusiasm. An assembly of notables met and declared him king with the title of William I., king of the Netherlands, in 1814. By the treaty of Paris Belgium was united to Holland, and the seventeen provinces were again forcibly joined together under one prince. It was settled that the house of Orange should have the hereditary sovereignty, with a fairly liberal constitution. To make up to the new king for the loss of his territories in Germany, the grand duchy of Luxembourg, with the exception of the town and fortress of Luxembourg, was handed over to him as his private possession, not as a part of the kingdom; the bishopric of Liège and the duchy of Bouillon also went with it. The episode of the "Hundred Days," though it delayed the conclusion of the very complicated arrangements involved in these transfers, gave the new kingdom an opportunity of distinguishing itself: it was the first point of attack, and met the crisis with vigor. The Dutch troops under William, eldest son of the new king, took considerable part in the short and striking campaign which was closed on June 18, 1815, by the final victory of Waterloo.

The allied powers now founded in Holland and Belgium what they hoped would be a solid and permanent kingdom as a barrier against France. It was felt that Napoleon had shown Europe the importance of this district in connection with this scheme for European domination. The new kingdom under the house of Orange was therefore the subject of great and anxious consideration at Vienna. The king, an hereditary sovereign, received full executive powers, and the initiative in proposing laws. He had also the power of appointing his own council of state. As a legislative body there were the States-General, divided into two chambers each province had also its own local states. Freedom of worship and political equality were secured for all.

A highly artificial arrangement like this, however, could not stand long, if Europe came to throw off the trammels of the monarchical reaction, and to give freer course to those liberal tendencies which had survived the drama of the French Revolution. In religious belief, in laws and usages, in language, in interests, the Belgic and Batavian provinces had little in common. Their inhabitants were different races, with instincts and feelings not merely diverse but opposed. The Belgic provinces spoke French or Walloon; the Batavians, Dutch. The Belgians were strict Catholics, while the Dutch were Protestants. The Dutch were chiefly a commercial and seafaring people, with interests in distant lands and colonial possessions; the Belgians were agriculturists, except where their abundance of minerals made them manufacturers. The Dutch connected themselves with Germany and (though often only by way of rivalry) with England; the Belgians drew their chief inspirations from France, and connected themselves with the French in traditions, religion and commercial interests. Such a diversity could not possibly stand the brunt of any great political movement; especially as the Dutch were oppressive toward their Belgian partners in the kingdom. Accordingly we find that in 1830 the revolution at Paris at once aroused the strongest sympathy at Brussels. The dull obstinacy of William I. had emphasized the divergence, and his narrow and antiquated policy rendered an outburst inevitable.

The revolt at Brussels, which began on August 25, 1830, spread instantly throughout the whole of Belgium. After a short struggle in November, a conference of France, England, Prussia, Austria and Russia, sitting in London at the request of William I., proposed an armistice, to which both parties agreed. In the following January the conference attempted to settle the terms of a separation, and proposed that Holland should have Luxembourg and part of the left bank of the Scheldt; this the Dutch accepted, while the provisional government at Brussels protested against it. The assembly at Brussels constructed a new and liberal constitution, with a broad representative government, liberty of teaching, of the press, of public meeting; and in April, 1831, the crown was offered to Leopold of Saxe-Coburg, who, after ascertaining that he would be recognized by England and France, did not hesitate to accept it (see BELGIUM). This appointment caused the utmost irritation at the Hague, and the Dutch suddenly invaded Belgium; the opportune appearance of a French army checked the Dutch advance, and gave diplomacy time to interfere. The citadel of Antwerp, however, was still in Dutch hands, and the allied powers used in vain all their influence to persuade William I. to give it up to the Belgians. War was hereon declared, and France and England blockaded the Dutch ports, while a French army attacked the citadel, and, after a sharp struggle compelled it to capitulate. The forts of Lillo and Liefkenshoek were left in the hands of the Dutch; on May 21, 1833, there was signed at London by the plenipotentiaries of Holland on one side and those of England and France on the other, a convention in which William I. engaged not to recommence hostilities against Belgium, and to leave the Scheldt navigation open, till the relations between the two countries should be definitely settled by treaty. The final settlement of outstanding questions, however, was not reached till six years later, when Limburg and the eastern part of Luxembourg were secured to Holland, and heavy tolls were imposed on the navigation of the Scheldt; then the two kingdoms finally parted company on April 19, 1839.

In the following year William I. resigned his crown to his son William II., who reigned in peace till his death in 1849, when he was succeeded by his eldest son William III., who still reigns. The wave of revolution which passed over Europe in 1848 had in Holland comparatively little effect; the constitution of 1814 was revised, and the tranquillity of the country secured. In 1853, after the establishment by the papacy of Catholic bishoprics in England and Holland, a considerable excitement arose, which resulted in the accession to power of a moderate, liberal, and entirely Protestant cabinet, and in the main the Protestant-liberal party has guided the country for the last quarter of a century. The Dutch took but a secondary part in the disputes between France and Germany as to Dutch Luxembourg. The present titular ruler of Holland is a young girl, and the country is under a regency.

HOLLAND, or HOLLAND AND WEST FRIESLAND, was the second province of the republic of the United Netherlands, and consisted of the old countship of Holland, with the addition of the lordship of Voorne. In 1801, after the erection of the Batavian republic, very nearly the same area was included in the "department" of Holland; but when, in June, 1806, Holland became the name of the new kingdom, it ceased to be applied to any of the administrative divisions. On the establishment of the kingdom of the Netherlands in 1814 the province of Holland was restored, with its ancient limits only slightly modified. A few further alterations were made

in 1815, 1819, and 1820. It was the only province that had two governors, one for the north and another for the south, and the provincial states met alternately at the Hague and at Haarlem. In 1840 this bipartite arrangement was carried to its logical conclusion by the erection of two distinct provinces called respectively North and South Holland.

HOLLAND, SIR HENRY, physician and author, was born at Knutsford, Eng., October 27, 1788.

He was the author of *General View of the Agriculture of Cheshire*, 1807; *Travels in the Ionian Isles, Albania, Thessaly, and Greece*, 1812-13, 2d ed., 1819; *Medical Notes and Reflections*, 1839; *Chapters on Mental Physiology*, 1852; *Essays on Scientific and Other Subjects contributed to the Edinburgh and Quarterly Reviews*, 1862; and *Recollections of Past Life*, 1872, which is less interesting than it might have been, owing to the reticence of the author in regard to personal details and characteristics. He died in 1873.

HOLLAND, PHILEMON, usually styled, in the words of Thomas Fuller, "the translator-general of his age," was born in 1551 at Chelmsford, England, and died in 1636.

HOLLAND, HENRY RICHARD VASSALL FOX, THIRD BARON, nephew of Charles James Fox, and only son of Stephen Fox, second Lord Holland, was born at Winterslow House, Wiltshire, November 21, 1773.

Lord Holland's early inheritance of a peerage must be regarded rather as a misfortune than an advantage, for it debarred him from a career in the House of Commons which might have proved as brilliant as that of his uncle Charles Fox, and raised him to an assembly, not only more listless and much less numerous, but where, at the time he entered it, the Whig party, of whose principles the influence of his uncle had induced him to become a strenuous supporter, could muster only a minority of six or seven in a house of eighty or ninety. He began his political career by a motion against the Assessed Tax Bill, and though his speech had, as was to be expected, no influence on the division, it proved that he had inherited the oratorical abilities of his family, and pointed him out as the leader of his uncle's supporters in the Upper House. As his disapproval of most of the proceedings of the House of Lords was recorded by protests, his copiousness in this species of composition has perhaps never been equaled. These protests were afterward collected and published by D. C. Moylan under the title *The Opinions of Lord Holland as recorded in the Journals of the House of Lords, from 1797 to 1841* (London, 1841), and, besides constituting, as they necessarily do, a full though condensed account of his political views and opinions, form one of the most authentic and original records of the course of Whig policy during the years to which they refer. After the peace of Amiens in 1802 Lord Holland proceeded to Paris, whence he went to Spain, staying in that country until the declaration of war in January, 1805, when he returned to England. Of this second visit to Spain he doubtless took advantage for the purpose of acquiring a more complete mastery of the Spanish language and literature, and the fruit of this was seen in the publication, in 1807, of *The Life and Writings of Lope Felix de Vega Carpio*, and in 1808 of *Three Comedies from the Spanish*. When the ministry of "All the Talents" came into office in 1806, Lord Holland was made a privy councilor, and was appointed, along with Lord Auckland, to negotiate with the American plenipotentiaries that treaty the refusal of whose ratification by Mr. Jefferson resulted in the subsequent war with America. On the death of Mr. Fox, October 15th, following, Lord Holland received the privy seal, holding office till the dismissal of

the ministry in 1807. When the Spaniards rebelled against the French yoke in 1808, Lord Holland's interest in the country induced him to pay it a third visit. He landed at Corunna almost simultaneously with the division of the British army under Sir David Baird, and did not return to England till the close of 1809. During the long period when the Whigs were excluded from power, Lord Holland continued to afford them his strenuous and steady support. He did not join the Canning ministry of 1827, but when the Whigs were recalled in 1830, he became chancellor of the duchy of Lancaster, an office which, with the exception of two short intervals when his party were temporarily excluded from power, he continued to hold till his death at Holland House, October 22, 1840.

HOLLAR, WENZEL, or WENCESLAUS, a celebrated etcher, was born at Prague on July 13, 1607, and died at Westminster, being buried at St. Margaret's church on March 28, 1677.

HOLLY, *Ilex*, L., a genus of trees and shrubs, of the natural order *Ilicineæ Aquifoliaceæ*, containing some one hundred and fifty species, of which several occur in the temperate northern hemisphere, Northwest America excepted, by far the larger number in tropical Asia and America, and very few in Africa and Australia.

The wood of the holly is even-grained and hard, especially when from the heartwood of large trees, and almost as white as ivory, except near the center of old trunks, where it is brownish. It is employed in inlaying and turning, and, since it stains well, in the place of ebony, as for teapot handles. For engraving it is inferior to box. When dry it weighs about 47½ pounds per cubic foot. From the bark of the holly birdlime is manufactured. From the leaves are obtainable a coloring matter named *ilixanthin*, *ilicic acid*, and a bitter principle, *ilicin*, which has been variously described by different analytical chemists. The leaves have been used in rheumatism, and were at one time, on account of their bitter taste, supposed to be of value in intermittent fever. A. Lonicerus speaks of their decoction as a remedy for pain in the side. They are eaten by sheep and deer, and in parts of France serve as a winter fodder for cattle. The berries provoke in man violent emesis and catharsis, but are eaten with immunity by thrushes and other birds. The custom of employing holly and other plants for decorative purposes at Christmas is one of considerable antiquity, and has been regarded as a survival of the usages of the Roman Saturnalia, or of an old Teutonic practice of hanging the interior of dwellings with evergreens as a refuge for sylvan spirits from the inclemency of the weather.

HOLLYHOCK, *Althæa rosea*, L., a perennial plant of the natural order *Malvaceæ* and tribe *Malvææ*, a native of the East, has been cultivated in Great Britain for about three centuries. The ordinary hollyhock is single-blossomed, but the florists' varieties have all double flowers, of white, yellow, rose, purple, violet, and other tints, some being almost black. The plant is in its prime about August, but by careful management examples may be obtained in blossom from July to as late as November. Hollyhocks are propagated from seed, or from division of the root or by planting out in rich sandy soil, in a close frame, with a gentle bottom heat, single eyes from woodshoots, or cuttings from outgrowths of the old stock or of the lateral offsets of the spike. The seed may be sown in October under cover, the plants obtained being potted in November, and kept under glass till the following April, or, if it be late-gathered, in May or June, in the open ground, whence, if required, the plants are best removed in October or April.

HOLMAN, JAMES, the "Blind Traveler," was born

about 1787. He entered the British navy in 1798 as first-class volunteer, and was appointed lieutenant in April, 1807. In 1810 he was invalided by an illness which resulted in the total and hopeless deprivation of sight. In consideration of his helpless circumstances, he was in 1812 appointed one of the royal knights of Windsor, but the dullness and seclusion of such a life harmonized so ill with his active habits and keen interest in the outside world, that he requested leave of absence that he might go abroad. This being granted, he, in 1819, 1820, and 1821, journeyed through France, Italy, Switzerland, the parts of Germany bordering on the Rhine, Belgium, and the Netherlands. In 1822 he published a narrative of his journey. He published in four volumes in 1824-35, under the title of *A Voyage round the World, including Travels in Africa, Asia, Australasia, America, etc., from 1827 to 1832*, an account of his extensive travels. His last journeys were through Spain, Portugal, Wallachia, Moldavia, Montenegro, Syria, and Turkey; and he was engaged in preparing his journals of this tour for the press when he died at London, July 29, 1857.

HOLSTEIN. See SCHLESWIG-HOLSTEIN.

HOLT, SIR JOHN (1642-1710), lord chief-justice of the court of King's Bench in the reigns of William III. and Anne, was born at Thame, Oxfordshire, December 30, 1642. In February, 1666, he was appointed recorder of London, and on the 22d of April he was made king's sergeant, and received the honor of knighthood. Having been one of the judges who acted as assessors to the peers in the Convention parliament, he took a leading part in arranging the constitutional change by which William III. was called to the throne, and after his accession he was appointed lord chief-justice of the king's bench. His merits as a judge are the more apparent and the more remarkable when contrasted with the qualities displayed by his unworthy predecessors in office. In judicial fairness, legal knowledge and ability, clearness of statement, and unbending integrity, he has had few if any superiors on the English bench. While steadfast in his sympathies with the Whig party, Holt maintained on the bench entire political impartiality, and always held himself aloof from political intrigue. On the retirement of Somers from the chancellorship in 1700 he was offered the great seal, but declined it. His death took place March 3, 1710, and he was buried in the chancel of Redgrave church, where a fine monument in white marble was erected by his brother to his memory.

HÖLTY, LUDWIG HEINRICH CHRISTOPH, German poet, and one of the founders of the "Hainbund," was born at Mariensee in Hanover, December 21, 1748, and died in 1776.

HOLYHEAD, a market-town and parliamentary borough of Anglesey, North Wales, is situated on a small island on the western extremity of the county and at the terminus of the Chester and Holyhead Railway, twenty-four miles from Bangor. Population, 10,000.

HOLY ISLAND, or **LINDISFARNE**, an irregularly shaped island in the North Sea, ten miles south-southeast of Berwick, and two miles from the coast of Northumberland, in which county it is included. It is joined to the mainland at low water by flat sands, over which a track, marked by wooden posts and practicable for vehicles, leads to the island.

HOLYOKE, a Massachusetts city, is situated in a curve of the Connecticut river, in Hampden county, on the west bank of the stream, about 105 miles west of Boston. The town lies upon the slope of a hill, and is well laid out, and contains some handsome buildings, the most notable public structure being the granite city hall. There are numerous churches, the principal de-

nominations being represented—the Roman Catholics, among others, having, beside their houses of worship, several convents, a home for girls, and an orphanage. The town is fully abreast with the times, having several newspapers, a full quota of national and other banks, and all the improvements and appliances of modern city life. Its municipal government is well administered, and its water, fire, and police departments are efficient and well organized. The streets are well lighted, and the board of public works attentive to their duties and responsibilities. The commercial interests of the city are considerable, and are constantly increasing. But Holyoke is a manufacturing city *par excellence*. The river is crossed here by a dam, which furnishes motive power for a large number of manufactories, which include in their productions an almost endless variety of goods. The city is the seat of extensive paper-making industries, so large as to make its claim of being the largest producer of that article in the world, perhaps justifiable. Cotton, woolen, and silk goods are also made in large quantities, while iron, steel, screws, lumber, sash, doors, and blinds, together with flour, mechanics' tools, files, cutlery, etc., go to make up industries in which a large capital and many operatives are employed. The school facilities of the city are unexcelled, the excellent common-school system being supplemented by the Roman Catholic parish schools. There is an excellent public library in the city. The city has some fishery interests, a large number of shad being seined in season. On the opposite side of the river is the town of South Hadley, with which it is connected by bridge. The city is surrounded by low mountains, or rather high ridges, the principal elevations of which are Mount Holyoke and Mount Tom. Several railroads center here, giving communication with all sections of the continent; and various telegraph lines connect it with the business centers of the country. The growth of the city is steady, both in population and wealth, the number of inhabitants being in 1890 (U. S. census), 35,637.

HOLY WATER, in Roman Catholic ritual, is a specially exorcised and consecrated mixture of salt and water, believed to possess, when duly sprinkled, peculiar potency as a remedy for sickness, mental or bodily, and as a protection to property. According to present usage prescribed in the *Missal*, it is prepared in the sacristy on Sunday by the priest who is to celebrate high mass (or by some other on whom the duty is devolved): robed in alb and superpelliceum and wearing his stole, he first exorcises the salt and water separately; next he mixes the two in the name of Father, Son and Holy Ghost; and finally he pronounces the prayer of consecration over the mixture. Thereupon he assumes his pluvial, goes to the altar, and takes from the deacon the aspergillum, with which he sprinkles the altar, himself, his assistants, and the congregation, meanwhile repeating the words of Ps. li. 7. The faithful who desire it are afterward permitted to carry a supply home with them for application to the sick and for similar purposes. Holy water is solemnly used, not only in the consecration of sacred objects, such as churches, churchyards, bells, images, vestments, and the like, but also on various domestic occasions such as marriages and funerals.

HOLY WEEK, in the ecclesiastical year the week immediately preceding that of Easter. The earliest allusion to the custom of marking this week as a whole with special observances is to be found in the *Apostolical Constitutions* (v. 18, 19), dating from the latter half of the third century A.D. Abstinence from wine and flesh is there commanded for all the days, while for the Friday and Saturday an absolute fast is enjoined.

HOLYWELL (Welsh, *Treffynnon*, the town of the well), a parliamentary borough and market-town of Flintshire, North Wales, is beautifully situated on an eminence near the left bank of the estuary of the Dee, and about two miles from the station on the Chester and Holyhead line. Population 9,000.

HOLZMINDEN, the chief town of a circle in the duchy of Brunswick, Germany, is situated on the right bank of the Weser, at the foot of the Sollinger mountains, and on the railway from Kreiensen to Altenbeken. Population (1897), 7,500.

HOMAGE (from *homo*, through the Low Latin *hominaticum*, which occurs in a document of 1035) was one of the ceremonies used in the granting of the fief, and indicated the submission of a vassal to his lord. It could be received only by the suzerain in person. With head uncovered the vassal humbly requested to be allowed to enter into the feudal relation; he then laid aside his sword and spurs, ungirt his belt, and kneeling before his lord uttered words to this effect: "I become your man from this day forth, of life and limb, and will hold faith to you for the lands I claim to hold of you." The oath of fealty, which could be received by proxy, followed the act of homage; then came the ceremony of investiture, either directly on the ground or by the delivery of a turf, a handful of earth, a stone, or some other symbolic object. Homage was done not only by the vassal to whom feudal lands were first granted but by everyone in turn by whom they were inherited, since they were not granted absolutely but only on condition of military and other service. An infant might do homage, but he did not thus enter into full possession of his lands.

HOMBERG, WILHELM, an eminent natural philosopher, born at Batavia, January 8, 1652, was educated in Holland, studied law at Jena and Leipsic, and became an advocate at Magdeburg in 1674. At Paris, whither he repaired in 1691, he was elected a member of the Academy of Sciences, and became (1702) teacher of physics and (1705) private physician to the duke of Orleans. He died at Paris, September 24, 1715.

HOMBURG-VOR-DER-HÖHE, chief town of the circle of Obertaunus in the Wiesbaden government district of the Prussian province of Hesse-Nassau, is prettily situated on a small stream at the foot of a spur of the Taunus mountains, about eleven miles north of Frankfort-on-the-Main, with which it is connected by rail.

Homburg first came into repute as a watering-place in 1834, and owing to its gambling-tables, which were set up soon after, it rapidly became one of the favorite and most fashionable health-resorts of the Continent. In 1849 the town was occupied by Austrian troops for the purpose of enforcing the imperial decree against gambling establishments, but immediately on their withdrawal the bank was again opened, and play continued unchecked till 1872, when the Prussian Government refused to renew the lease for gambling purposes which then expired. As the capital of the former landgraviate of Hesse-Homburg the town shared the vicissitudes of that State. Population (1889), 10,500.

HOME, HENRY. See **KAMES, LORD**.

HOME, JOHN, Scottish dramatic poet, was born September 20, 1722, and died in 1808.

HOMEL, or **GOMOL**, a town of Russia in Europe, in the government of Mohileff, 132 miles south of Mohileff, on the highway to Tchernigoff, and on the right bank of the Sosh, which joins the Dnieper about forty-five miles farther down. Population, 13,000.

HOMER (*Ὅμηρος*) was by the general consent of antiquity the first and greatest of poets. Many of the works once attributed to him are lost; those which re-

main are the two great epics the *Iliad* and the *Odyssey*, about thirty *Hymns*, a mock epic (the *Battle of the Frogs and Mice*), and some pieces of a few lines each (the so-called *Epigrams*).

Ancient Accounts of Homer.—Of the date of Homer probably no record, real or pretended, ever existed. Herodotus maintains that Hesiod and Homer lived not more than 400 years before his own time, consequently not much before 850 B.C. From the controversial tone in which he expresses himself it is evident that others had made Homer more ancient; and accordingly the dates given by later authorities, though very various, generally fall within the tenth and eleventh centuries B.C.

The extant lives of Homer are eight in number, including the piece called the *Contest of Hesiod and Homer*. The longest is written in the Ionic dialect, and bears the name of Herodotus, but is certainly spurious. The other lives are probably not more ancient. They contain a strange medley, ranging from the simplest outgrowth of popular fancy to the frigid inventions of the age which would not confess itself ignorant of the name of Hecuba's mother. Thus the story that Homer was the son of the Meles (the river on which Smyrna is situated) and the nymph Critheis is evidently a local legend. Another story of a primitive cast describes the manner of Homer's death in the Island of Ios. Seeing some young fishermen on the beach with their nets, he asked them—

"Fishermen sprung of Arcadia, have we aught?"

To which they answered in a riddle—

"What we caught we left behind,
What we caught not we bear with us."

Homer could not explain this, and then he remembered an oracle which had told him to beware of the young men's riddle. He wrote an epitaph for himself, and died on the third day after. This story comes from a lost work of Aristotle. On the other hand, when we are told in the Herodotean life that Critheis was a daughter of Melanopus, one of the colonists who came to Cyme from Magnesia, that being found to be with child she was sent with the fresh colony that founded Smyrna, that she there brought forth Homer on the banks of the Meles, whence he was called Melesigenes,—in this form of the story it is easy to recognize the hand of the critic. There is an evident desire to get rid of the primitive supernatural element, and also to reconcile the claims of two cities, Cyme and Smyrna, to the envied distinction of giving birth to Homer. There are other incidents in the Herodotean life which seem devised merely to fit certain of the minor characters in the Homeric poems. Phemius, we are told, was a schoolmaster of Smyrna, who was kind to the young Melesigenes, and was accordingly immortalized as the singer in the *Odyssey*; the original of Mentor was a man of Ithaca, who entertained Homer and tended him in illness; and so on.

The chief value of these "Lives," and especially of the Herodotean life, lies in the curious short poems which they have preserved. These poems are the *Epigrams* which used to be printed at the end of Homer, but are banished by the somewhat inconvenient purism of modern editors.

It is plain that the contention for the honor of being the birthplace of Homer began at a time when his real history had been lost. And since the inevitable legend found no clue in the *Iliad* and *Odyssey*, it was driven to seek for one in poems of secondary value.

Time and Place of Homer.—The oldest direct references to the *Iliad* and *Odyssey* are in Herodotus, who

quotes from both poems. The quotation from the *Iliad* is of interest because it is made in order to show that Homer supported the story of the travels of Paris to Egypt and Sidon (whereas the Cyclic poem called the *Cypria* ignored them), and also because the part of the *Iliad* from which it comes is cited as the "Aristeia of Diomedes." This was therefore a recognized part of the poem.

The earliest mention of the name of Homer is found in a fragment of the philosopher Xenophanes (of the sixth century B.C.) The passage shows, not merely that Homer was well known at Colophon in the time of Xenophanes, but also that the great advance in moral and religious ideas which forced Plato to banish Homer from his republic had made itself felt in the days of the early Ionic philosophers.

Failing external testimony, the time and place of the Homeric poems can only be determined (if at all) by internal evidence. This is of two main kinds: (1) evidence of history, consisting in a comparison of the political and social condition, the geography, the institutions, the manners, arts, and ideas of Homer with those of other times; (2) evidence of language, consisting in a comparison with later dialects, in respect of grammar and vocabulary. To these may be added, as occasionally of value, (3) evidence of the direct influence of Homer upon the subsequent course of literature and art.

Structure of the Iliad.—The subject of the *Iliad*, as the first line proclaims, is the "anger of Achilles." The manner in which this subject is worked out will appear from the following summary, in which we distinguish (1) the plot, *i. e.*, the story of the quarrel, (2) the main course of the war, which forms a sort of underplot, and (3) subordinate episodes.

- I. Quarrel of Achilles with Agamemnon and the Greek army—Agamemnon, having been compelled to give up his prize, Chryseis, takes Briseis from Achilles—Thereupon Achilles appeals to his mother Thetis, who obtains from Zeus a promise that he will give victory to the Trojans until the Greeks pay due honor to her son—Meanwhile Achilles takes no part in the war.
- II. Agamemnon is persuaded by a dream sent from Zeus to take the field with all his forces.
His attempt to test the temper of the army nearly leads to their return.
Catalogue of the army.
Trojan muster—Trojan catalogue.
- III. Meeting of the armies—Paris challenges Menelaus—Truce made.
"Teichoscopy," Helen pointing out to Priam the Greek leaders.
The duel—Paris is saved by Aphrodite.
- IV. Truce broken by Pandarus.
Advance of the armies—Battle.
- V. Aristeia of Diomedes—his combat with Aphrodite—Meeting with Glaucus—
- VI. Visit of Hector to the city, and offering of a peplos to Athene.
(1-311)
(312-529)
Visit of Hector to Paris—to Andromache.
- VII. Return of Hector and Paris to the field.
Duel of Ajax and Hector.
Truce for burial of dead.
The Greeks build a wall round their camp.
- VIII. Battle—The Trojans encamp on the field.
- IX. Agamemnon sends an embassy by night, offering Achilles restitution and full amends—Achilles refuses.
- X. Doloneia—Night expedition of Odysseus and Diomedes.
- XI. Aristeia of Agamemnon—he is wounded—Wounding of Diomedes and Odysseus.
Achilles sends Antilochus to inquire about Machaon.
- XII. Storming of the wall—the Trojans reach the ships.
- XIII. Zeus ceases to watch the field—Poseidon secretly comes to the aid of the Greeks.
- XIV. Sleep of Zeus by the contrivance of Hera.
- XV. Zeus awakened—Restores the advantage to the Trojans—Ajax alone defends the ships.

- XVI. Achilles is persuaded to allow Patroclus to take the field.
Patroclus drives back the Trojans—kills Sarpedon—is himself killed by Hector.
- XVII. Battle for the body of Patroclus—Aristeia of Menelaus.
- XVIII. News of the death of Patroclus is brought to Achilles—Thetis comes with the Nereids—promises to obtain new armor for him from Hephaestus.
The shield of Achilles described.
- XIX. Reconciliation of Achilles—His grief and desire to avenge Patroclus.
- XX. The gods come down to the plain—Combat of Achilles with Aeneas and Hector, who escape.
- XXI. The Scamander is choked with slain—rises against Achilles, who is saved by Hephaestus.
- XXII. Hector alone stands against Achilles—his flight round the walls—he is slain.
- XXIII. Burial of Patroclus—Funeral games.
- XXIV. Priam ransoms the body of Hector—his burial.

A recent writer (Dr. E. Kammer) has given some strong reasons for doubting the genuineness of the passage in book xx. describing the duel between Achilles and Aeneas (79-352). The incident is certainly very much out of keeping with the vehement action of that part of the poem, and especially with the moment when Achilles returns to the field, eager to meet Hector and avenge the death of his friend. The interpolation (if it is one) is probably due to local interests. It contains the well-known prophecy that the descendants of Aeneas are to rule over the Trojans—pointing to the existence of an Aenead dynasty in the Troad. So, too, the legend of Anchises in the Hymn to Aphrodite is evidently local; and Aeneas becomes more prominent in the later epics.

Structure of the Odyssey.—In the *Odyssey*, as in the *Iliad*, the events related fall within a short space of time. The difficulty of adapting the long wanderings of Ulysses to a plan of this type is got over by the device—first met with in the *Odyssey*—of making the hero tell the story of his own adventures. In this way the action is made to begin almost immediately before the actual return of Ulysses. Up to the time when he reaches Ithaca it moves on three distinct scenes: we follow the fortunes of Ulysses, of Telemachus on his voyage in the Peloponnesus, and of Penelope with the suitors. The art with which these threads are woven together was recognized by Wolf himself, who admitted the difficulty of applying his theory to the "admirabilis summa et compages" of the poem. Of the comparatively few attempts which have been made to dissect the *Odyssey*, the most moderate and attractive is that of Professor A. Kirchhoff of Berlin.

Chorizontes.—When we are satisfied that each of the great Homeric poems is either wholly or mainly the work of a single poet, a question remains which has been matter of controversy in ancient as well as modern times—Are they the work of the same poet? Two ancient grammarians, Xenon and Hellanicus, were known as the separators (*οἱ χωρίζοντες*); and Aristarchus appears to have written a treatise against their heresy. In modern times some of the greatest names have been on the side of the "Chorizontes."

If, as has been maintained in the preceding pages, the external evidence regarding Homer is of no value, the problem now before us may be stated in this form: Given two poems of which nothing is known except that they are of the same school of poetry, what is the probability that they are by the same author? We may find a fair parallel by imagining two plays drawn at hazard from the works of the great tragic writers. It is evident that the burden of proof would rest with those who held them to be by the same hand.

The arguments used in this discussion have been of very

various caliber. The ancient Chorizontes observed that the messenger of Zeus is Iris in the *Iliad*, but Hermes in the *Odyssey*; that the wife of Hephæstus is one of the Charities in the *Iliad*, but Aphrodite in the *Odyssey*; that the heroes in the *Iliad* do not eat fish; that Crete has a hundred cities according to the *Iliad*, and only ninety according to the *Odyssey*; that *προπάρουθε* is used in the *Iliad* of place, in the *Odyssey* of time, etc. Modern scholars have added to the list, especially by making careful comparisons of the two poems in respect of vocabulary and grammatical forms. Nothing is more difficult than to assign the degree of weight to be given to such facts. The difference of subject between the two poems is so great that it leads to the most striking differences of detail, especially in the vocabulary.

The *Iliad* is much more historical in tone and character. The scene of the poem is a real place, and the poet sings (as Ulysses says of Demodocus) as though he had been present himself, or had heard from one who had been. The supernatural element is confined to an interference of gods, which to the common eye hardly disturbs the natural current of affairs. The *Odyssey*, on the contrary, is full of the magical and romantic,—"speciosa miracula," as Horace calls them. Moreover, these marvels—which in their original form are doubtless as old as anything in the *Iliad*, since in fact they are part of the vast stock of popular tales (*Märchen*) diffused all over the world—are mixed up in the *Odyssey* with the heroes of the Trojan war. This has been especially noticed in the case of the story of Polyphemus, one that is found in many countries, and in versions which cannot all be derived from Homer. W. Grimm has pointed out that the behavior of Ulysses in that story is senseless and foolhardy, utterly beneath the wise and much-enduring Ulysses of the Trojan war. The reason is simple; he is not the same Ulysses, but a being of the same world as Polyphemus himself—the world of giants and ogres. The question, then, is—how long must the name of Ulysses have been familiar in the legend (*Sage*) of Troy before it made its way into the tales of giants and ogres (*Märchen*), where the poet of the *Odyssey* found it?

Again, the Trojan legend has itself received some extension between the time of the *Iliad* and that of the *Odyssey*. The story of the Wooden Horse is not only unknown to the *Iliad*, but is of a kind which we can hardly imagine the poet of the *Iliad* admitting. The part taken by Neoptolemus seems also to be a later addition. The tendency to amplify and complete the story shows itself still more in the Cyclic poets. Between the *Iliad* and these poets the *Odyssey* often occupies an intermediate position.

This great and significant change in the treatment of the heroic legends is accompanied by numerous minor differences (such as the ancients remarked) in belief, in manners and institutions, and in language. These differences bear out the inference that the *Odyssey* is of a later age. The progress of reflexion is especially shown in the higher ideas entertained regarding the gods. The turbulent Olympian court has almost disappeared. Zeus has acquired the character of a supreme moral ruler; and although Athene and Poseidon are adverse influences in the poem, the notion of a direct contest between them is scrupulously avoided. In matters bearing upon the arts of life it is unsafe to press the silence of the *Iliad*. We may note, however, the difference between the house of Priam, surrounded by distinct dwellings for his many sons and daughters, and the houses of Ulysses and Alcinous, with many chambers under a single roof. The singer, too, who is so prominent a figure in the *Odyssey* can hardly be thought to

be absent from the *Iliad* merely because the scene is laid in a camp.

Style of Homer.—A few words remain to be said on the style and general character of the Homeric poems, and on the comparisons which may be made between Homer and analogous poetry in other countries.

The cardinal qualities of the style of Homer have been pointed out once for all by Mr. Matthew Arnold. "The translator of Homer," he says, "should above all be penetrated by a sense of four qualities of his author—that he is eminently rapid; that he is eminently plain and direct, both in the evolution of his thought and in the expression of it, that is, both in his syntax and in his words; that he is eminently plain and direct in the substance of his thought, that is, in his matter and ideas; and, finally, that he is eminently noble."

The peculiar rapidity of Homer is due in great measure to his use of the hexameter verse. It is characteristic of early literature that the evolution of the thought—that is, the grammatical form of the sentence—is guided by the structure of the verse; and the correspondence which consequently obtains between the rhythm and the grammar—the thought being given out in lengths, as it were, and these again divided by tolerably uniform pauses—produces a swift flowing movement, such as is rarely found when the periods have been constructed without direct reference to the meter. That Homer possesses this rapidity without falling into the corresponding faults—that is, without becoming either "jerky" or monotonous—is perhaps the best proof of his unequalled poetical skill. The plainness and directness, both of thought and expression, which characterize Homer were doubtless qualities of his age; but the author of the *Iliad* (like Voltaire, to whom Mr. Arnold happily compares him) must have possessed the national gift in a surpassing degree. The *Odyssey* is in this respect perceptibly below the level of the *Iliad*.

Rapidity or ease of movement, plainness of expression, and plainness of thought, these are not the distinguishing qualities of the great epic poets—Virgil, Dante, Milton. On the contrary, they belong rather to the humbler epico-lyrical school for which Homer has been so often claimed. The proof that Homer does not belong to that school—that his poetry is not in any true sense "ballad poetry"—is furnished by the higher artistic structure of his poems (already discussed), and as regards style by the fourth of the qualities distinguished by Mr. Arnold—the quality of *nobleness*. It is his noble and powerful style, sustained through every change of idea and subject, that finally separates Homer from all forms of "ballad poetry" and "popular epic."

But while we are on our guard against a once common error, we may recognize the historical connection between the *Iliad* and *Odyssey* and the "ballad" literature which undoubtedly preceded them in Greece. It may even be admitted that the swift-flowing movement, and the simplicity of thought and style, which we admire in the *Iliad* are an inheritance from the earlier "lays"—the *κλέα ἀνδρῶν* such as Achilles and Patroclus sang to the lyre in their tent. Even the meter—the hexameter verse—may be assigned to them. But between these lays and Homer we must place the cultivation of epic poetry as an art. The pre-Homeric lays doubtless furnished the elements of such a poetry—the alphabet, so to speak, of the art; but they must have been refined and transmuted before they formed poems like the *Iliad* and *Odyssey*.

HOMESTEAD, a railroad, telegraph, and banking town of Alleghany county, Penn., lies about eight miles from Pittsburg. It is a suburban residence for some of the Pittsburg business men, and is growing steadily. Population (1890), about 5,000.

HOMESTEAD LAWS. Under the laws of the United States, as embodied in the acts of May 20, 1862, March 3, 1879, and May 6, 1886, any citizen who is twenty-one years of age or who is the head of a family may select from any of the surveyed and otherwise unappropriated public lands of the United States a homestead of 160 acres free of cost except entry fees. The law provides that the homestead shall be exempt from execution and from alienation by the householder. In order to obtain a homestead the applicant must make affidavit before a register and receiver of the land office that he is over twenty-one years of age, or is the head of a family, that he is a citizen of the United States or has declared in good faith his intention to become a citizen, and that he makes the entry for his exclusive use and benefit, and for actual settlement and cultivation. He must select a tract of land of agricultural character, located in a compact body, and upon which no one has a previous claim. The law requires that the homesteader must reside continuously upon his claim for five years, must cultivate it and make certain improvements upon it. Abandonment of the land or absence from it for a period of more than six months renders the entry liable to cancellation. The original entry gives the settler a "claim" only, and he acquires no title which he can convey until after he has made his "final proof." This consists in the affidavit of the settler and two witnesses that he has made actual settlement upon and has cultivated the land for five years, and that he is a citizen and has never perfected or abandoned an entry made under the homestead law. The land office then issues a patent and the settler acquires a permanent and absolute title to his homestead. Soldiers and sailors of the War of the Rebellion, who served ninety days or more in the Union army or navy may count their term of service (not exceeding four years) as residence upon the land, but they cannot perfect title without at least one year's continuous residence upon the land. There are also provisions for "additional entry," where the original entry was less than 160 acres, but the additional entry must be upon lands adjoining the original lands, or the settler may surrender his original entry and make another of full size. Soldiers and sailors who, prior to June 22, 1874, made homestead entries of less than 160 acres, may select their additional entries from any unoccupied lands.

Under the preëemption laws 160 acres (only eighty acres in some States) can be obtained by actual settlers on payment of \$1.25 per acre for the "minimum" lands, or \$2.50 per acre for the "double minimum" lands. The latter are lands where alternate sections have been granted to railroads, or other works of public improvement. The commissions and fees on 160 acres range from \$18 to \$26 in the prairie and Southern States, but the commissions are higher in the Rocky Mountain States and Territories. A homesteader not wishing to remain the full term of five years on his land may, after residence and cultivation, pay for it with cash, warrants or scrip, thus virtually becoming a preëemptor. The preëemptor must settle upon and improve the land. The law as to actual settlement is imperative, but the amount of improvements necessary to satisfy the Land Office authorities varies. In cases of crops ruined by drought or insects an absence of a year is sometimes allowed, in the discretion of the department. A habitable house, according to the means of the settler, and absolutely occupied by himself and family, is a pre-requisite. To make and perfect a claim under the homestead law the settler must be a citizen, native or naturalized, but a preëemption entry may be completed by one who has simply declared his intention to become a citizen. A preëemptor who has obtained title may settle another

tract under the homestead law, and while residing upon his preëemption or homestead claim may enter yet another 160 acres under the "timber culture" law. Lands entered under the homestead and preëemption laws are exempt from taxation during the term of residence necessary to acquire title.

The public lands now for disposal are within the States of Florida, Alabama, Wisconsin, Mississippi, Illinois, Indiana, Michigan, and Ohio, and the States and Territories west of the Mississippi. Texas owns her own lands, and the Indian Territory is not open to settlement. The homestead exemption laws vary in different States and Territories. In some the value exempt from execution ranges from \$1,000 to \$2,500; in others the homestead proper is exempt, whatever its value may be.

The report of the General Land Office for 1889 says: "According to a very moderate estimate the number of land patents issued up to June 30, 1889, to homesteaders, to actual settlers on our public domain under the homestead act, was 297,208, embracing an area of 74,302 square miles, or 47,553,280 acres, and with other donations of lands to the people comprising an area nearly equaling the aggregate area of the original New England States, and that of the great States of New York, Pennsylvania and New Jersey, an area more than four and a half times greater than that certified up to the same date to corporations since 1861 in aid of railroad construction."

HOMEYER, KARL GUSTAV, Swedish author, was born August 13, 1795, at Wolgast, a small town in Pomerania, and died in 1874.

HOMICIDE, in law, is the act of killing a human being, whether such act be criminal or not. Blackstone distinguishes three kinds of homicide—(1) justifiable, (2) excusable, and (3) felonious.

The most important case of justifiable homicide is the execution of a criminal in due course of public justice. This condition is most stringently interpreted. "To kill the greatest of malefactors deliberately, uncompelled, and extra-judicially is murder. * * * And further, if judgment of death be given by a judge not authorized by lawful commission, and execution is done accordingly, the judge is guilty of murder" (Stephen's *Commentaries*, book vi. c. iv.) The execution must be carried out by the proper officer or his deputy; any person executing the sentence without such authority, were it the judge himself, would be guilty of murder. And the sentence must be strictly pursued; to execute a criminal by a kind of death other than that to which he has been judicially condemned is murder.

Homicide committed by an officer of justice in the course of carrying out his duty, as such, is also justifiable; e.g., where a person resists a legal arrest and is killed in the struggle; where officers in dispersing a riotous assemblage kill any of the mob, etc. In these cases the homicide must be shown to have been absolutely necessary. Again, homicide committed for the prevention of forcible and heinous crime, such as violent robbery, or murder, or housebreaking during the night, is justifiable.

Excusable homicide is homicide committed either by misadventure or in self-defense. In the former case, where a man in the course of doing some lawful work, accidentally and without intention kills another, the homicide is excused; e.g., shooting at a mark and undesignedly hitting and killing a man. The act must be strictly lawful, and death by misadventure in unlawful sports is not a case of excusable homicide. Homicide in self-defense is excusable when the slayer is himself in immediate danger of death, and has done all he could to avoid the assault.

HOMILY, HOMILIARIUM, BOOKS OF HOMILIES, meaning communion, intercourse; and especially interchange of thought and feeling by means of words (conversation), was early employed in classical Greek to denote the instruction which a philosopher gave to his pupils in familiar talk. The custom of delivering expositions or comments more or less extemporaneous on the lessons of the day at all events passed over soon and readily into the Christian Church, as may be gathered from the first *Apology* of Justin Martyr, where we read that, in connection with the practice of reading portions from the collected writings of the prophets and from the memoirs of the apostles, it had by that time become usual for the presiding minister to deliver a discourse in which "he admonishes the people, stirring them up to an imitation of the good works which have been brought before their notice." This discourse, from its explanatory character, and from the easy conversational manner of its delivery, was regarded as part of the regular duty of the bishop, but he could devolve it, if he thought fit, on a presbyter, or deacon, or even on a layman. In the smaller and remoter communities it not uncommonly happened that the minister was totally unqualified to undertake the work of preaching; and though, as is curiously shown by the case of Rome, the regular exposition of the appointed lessons was by no means regarded as part of the necessary business of a church, it was generally felt to be advisable that some provision should be made for the public instruction of congregations. Thus the finally fixed meaning of the word homily as an ecclesiastical term came to be a written discourse (generally possessing the sanction of some great name) read in church by or for the officiating clergyman when from any cause he was unable to deliver a sermon of his own. As the standard of clerical education sank during the dark ages, the habit of using the sermons of others became almost universal. Among the authors whose works were found specially serviceable in this way may be mentioned the Venerable Bede, who is credited with no fewer than 140 homilies in the Basel and Cologne editions of his works, and who certainly was the author of many *Homiliæ de Tempore* which were much in vogue during the eighth and following centuries. Prior to Charlemagne it is probable that several other collections of homilies had obtained considerable popularity, but in the time of that emperor these had suffered so many mutilations and corruptions that an authoritative revision was felt to be imperatively necessary. The result was the well-known *Homiliarium*, prepared by Paul Warnefrid, otherwise known as Paulus Diaconus.

The *Books of Homilies* referred to in the thirty-fifth Article of the Church of England originated at a convocation in 1542, at which it was agreed "to make certain homilies for stay of such errors as were then by ignorant preachers sparkled among the people." Certain homilies accordingly, composed by dignitaries of the lower house, were in the following year produced by the prolocutor; and after some delay a volume was published in 1547 entitled *Certain sermons or homilies appointed by the King's Majesty to be declared and read by all parsons, vicars, or curates every Sunday in their churches where they have cure*.

HOMŒOPATHY (from *ὁμοιοπάθεια*, a similarity of feeling or condition), as a distinctive system of medicine, owes its origin to Hahnemann, a German physician. (See HAHNEMANN.) It is customary to regard homœopathy as a mere system of therapeutics, having reference only to the question how and on what principle is disease to be treated. But a careful student of Hahnemann or of his *Organon* will soon discover that the system with which his name is fundamentally associated

is one not merely of therapeutics, but of pathology, and that any complete exposition of it must embrace an account of Hahnemann's views of the ultimate nature and cause of disease, as well as of the remedies by which it is to be combated, and the principles or principle on which these are to be selected.

Hahnemann taught that disease is to be regarded as consisting essentially of the symptoms of it as experienced and expressed by the patient, or as detected by the physician; in other words, that the chief symptoms, or the "totality of the symptoms," constitute the disease, and that disease is in no case caused by any material substance, but is only and always a peculiar, virtual, dynamic derangement of the health. It was a very essential part of Hahnemann's teaching that nature is a bad physician, and not to be much trusted; that drugs are the real curative agents provided by the beneficence of the Almighty; that drugs given to healthy persons have a power of producing symptoms of disease. The ascertainment of the symptoms produced by drugs in healthy persons is called technically "proving," and the record of such provings constitutes a large part of the literature of homœopathy. This power of drugs he perpetually refers to as their "pathogenetic power." His great therapeutical doctrine, for formulating which his followers call him, with doubtful taste, "the Messiah of Medicine," was to this effect, that there is a correspondence between the symptoms produced by any given drug administered to a healthy person, and its power of curing any given disease, and that the remedy for any given disease, that is, for any set of symptoms "in their totality," is that drug which, given to any healthy person, will produce the most perfect imitation of the said set of symptoms; in other words, *Similia similibus curantur*. Further, the dose of medicine is to be so attenuated as to cure the disease without hurting the patient. This attenuation of medicines constitutes, not only the most popular note of the system of Hahnemann, but that feature of it which is most characteristic of his own views and practice, and which in well-known words he declared to be established beyond the reach of cavil from future experience either of allopaths or of practitioners of the "new mongrel system made up of a mixture of allopathic and homœopathic processes." He gives minute directions as to the processes by which this attenuation is to be achieved, the principal of which are trituration, succussion, and dilution. Hahnemann held that medicines became, for curative purposes, more powerful as they became more attenuated; in his last edition of the *Organon* (1833), and in its last pages, he gave the most expressive evidence of his belief in the virtue of attenuation by saying that he could scarcely name one disease which in the last year he and his assistants had not treated with the most happy results, solely by means of "olfaction;" and he added that a patient even destitute of the sense of smell may expect an equally perfect action and cure from the medicine by olfaction. He condemned strongly the administration simultaneously of a number of medicines, and insisted that only one should be given at a time. Finally, it would be unjust to him not to bear in mind that he claimed to base his views and practice on experience and sound experiment. Some points of his system were borrowed by Hahnemann from previous writers — as, indeed, he himself, though imperfectly, admits. Not to mention others, he was anticipated by Hippocrates, and especially by Paracelsus (1495–1541), in his doctrine of *Similia similibus curantur*, if not in its exclusive application.

It is very remarkable that in Hahnemann's enumeration of authors who anticipated him in regard to the doctrine of *Similia*, he makes no mention of the views

of Paracelsus, though the very words seem to be taken from the works of that physician. The other point in Hahnemann's doctrine — that medicines should be tried first on healthy persons — he admits to have been enunciated by Haller. Roughly it has been acted on by physicians in all ages, but certainly more systematically since Hahnemann's time, though the result is often not such as to support his theory in regard to the action of medicine on the diseased as compared with the healthy body.

In the most characteristic feature of Hahnemann's practice — "the potentizing," "dynamizing," of medicinal substances — he appears to have been original. It has been generally affirmed that he was led to adopt his doctrine of "attenuation" by the fact that the medicines he administered produced similar effects to those of the disease, and that in any gross quantity, as he admitted, they would aggravate matters. But another and a chief reason is to be found in his views of the "spiritual," "immaterial," "dynamic" origin of disease and his resentment against the old modes of practice of medicine.

The followers of Hahnemann are true to him in making light comparatively of pathological facts, and giving their main attention to therapeutics. They are still concerned mainly with medicines. For some years Hahnemann's disciples continued pretty faithful to the doctrine of *Similia similibus curantur*, but they were not long in making some changes in it. Doctor Sharp, of Rugby, who had striven hard to overcome objectors, while admitting the doctrine of *Similia*, requires that it have regard, not to mere symptoms, but to the seat and pathology of the case; that the drug used be one which shall affect the organ at fault. Homœopathy cannot become a science till it is founded on what he calls Organopathy, or a much more careful consideration of the seat of disease than is involved in Hahnemann's views, who, he complains, passionately rejected pathology and morbid anatomy. In 1878 Doctor Kidd, the leading consultant among homœopathic practitioners in London, published a book on the *Laws of Therapeutics*. It is true that he does not carry the pluralizing far; he only substitutes two for Hahnemann's one law; but it is not the less a very remarkable departure. He is still faithful to the idea of a relationship between the action of medicines on the healthy and their curative value in sickness; but the law of *Similia* is sadly compromised. "In most cases that relationship is either of *similarity* or of *contrariety*." "Looking," says he, "to the observation of facts apart from theoretic speculations, two primary laws of therapeutics unfold themselves. Those two laws of therapeutics may well be called Galen's law, founded upon the rule of *contraria contrariis*, and Hahnemann's or the homœopathic law, founded upon the relationship of similars." The practice of Hahnemann as to the use of highly attenuated doses of medicine is evidently not more closely adhered to than his doctrine of *Similia*. This fact is the subject of complaint in homœopathic journals. The *Medical Investigator* says reprovingly: "How many claiming to be homœopaths are daily entirely disregarding the law of *Similia*. It is getting to be quite a rare thing to hear of a homœopathic practitioner conducting a serious case from beginning to end without using as such cathartics, sudorifics, diuretics, etc., in direct opposition to our law; not only are these drugs used in this way, but there are some also go so far as to say that they cannot be dispensed with." Doctor Wyld, the vice-president of the British Homœopathic Society, in a letter to Dr. W. B. Richardson, published in the *Lancet*, arguing for an abolition of the schism of the profession on this question, thus sums up the admissions which he as a somewhat representative man was prepared to make: "First, that

the views expressed by Hahnemann are often extravagant and incorrect; *Secondly*, that Hippocrates was right when he said some diseases are best treated by similars and some by contraries, and therefore it is unwise and incorrect to assume the title of homœopathist; *Thirdly*, that although many believe that the action of the infinitesimal in nature can be demonstrated, its use in medicine is practically by a large number in this country all but abandoned." It must not, however, be supposed that there are not many true believers in Hahnemann's doctrines both of *Similia*, etc., and of infinitesimal doses, extending even to olfactions.

Homœopathy has a considerable number of adherents in Great Britain, in the United States, and on the continent of Europe. In order to ascertain the esteem accorded to it in the land of its origin, inquiries have been made of neutral and unbiased authorities, and the general result is that it has no scientific recognition, but that many of the public believe in it, and consult practitioners who profess to practice it. The system has no place in any of the universities of Germany, nor does it seem to have a single school of its own in the entire German empire. It is universally condemned in Germany by men who have anything to do with biological science, and even in the lectures on therapeutics it is not mentioned at all. In Great Britain the Medical Act of 1858 gives power to the Privy Council severely to prohibit attempts by any examining body to impose restrictions as to any theory of medicine or surgery on candidates for examination. There is a homœopathic hospital with 100 beds in London, to which is attached a homœopathic school. Homœopathy is not strong in England. In the United States homœopathy has naturally had freer scope than in Europe. Some have estimated the proportion of homœopathic practitioners in the States as being one-eighth of the whole number of legally qualified practitioners. Every State determines for itself the conditions of qualification in medicine; and there is thus a vast number of separate medical schools giving both education and diplomas. Consequently there is a serious inequality in the severity of medical education and examination.

In all countries the doctrine of homœopathy is still without broad scientific recognition; and certainly in England its chief representatives are anxious to cease their existence as a distinctive school, and have, by their avowed departure from Hahnemann's law of *Similia*, and his mode of attenuating and administering medicines, brought themselves under the severest condemnation of their master's few faithful followers, among whom are still included men of high character. We need not discuss in detail the individual doctrines of Hahnemann, especially those just referred to, as they are scarcely fought for by those who now represent what remains of the homœopathic school. Hahnemann's fundamental views of disease deserve more attention. He despised any deep study of disease, and theorized about it instead. Had he carefully inquired into the nature and natural history of disease as Hippocrates did, or as he himself inquired into the sensations of those who took infinitesimal doses, he would have done more for the world and his own reputation. Hahnemann was easily captivated by theories, and not very sound in his reasoning. But underlying all his system, as we have seen, was the idea that the causes of disease were impalpable, immaterial, spiritual, dynamic. And this great foundation was rotten. Modern medicine is doing some of its best work in showing the material and the visible character of the causes of many of the commonest diseases, and suggests this in many cases where it has not as yet been demonstrated. The cause of many diseases is shown to be a living

germ or particle which can be discerned under the microscope, can be carried on a lancet or in a tube, and inserted under the skin so as to produce its peculiar disease. This is true of small-pox, Hahnemann notwithstanding. The germ can be preserved or it can be killed, and thus disease can be propagated or prevented. The close air of workshops, which generates consumption in such amount, can be shown to be full of impurities, chemical or organic. The causes of other diseases are often, not merely visible under a microscope, but coarsely visible. We have been lately told on high authority that to produce certain forms of blood-poisoning one or two ounces at least of septic fluid are necessary. So with other forms of common disease. Alcohol does not destroy a liver or kidney in any dynamic or immaterial form, but in coarse quantities diligently repeated. The lead which paralyzes the painter's wrist is not a "spiritual" thing. It is an accumulation of matter in the wrong place, and enters his body in palpable quantities, and, what is more, can be recovered in similar quantities from his body. So with the uric acid or its salts in the blood of a person who has inherited his father's gout, and perhaps his port wine. It is not a "spiritual" affair at all, but can be demonstrated chemically and under the microscope. The itch, to whose mysterious workings Hahnemann attributed two-thirds of the internal diseases of the body, including mania, cancer, gout, etc., is easily demonstrated to be dependent on an ugly crab-like insect, which can be destroyed in a few hours with sulphur, when there is an end both of it and of the itch. We are aware of the euphemistic form which is given to Hahnemann's views of the psoric or itch disease; and we are partly disposed to admit, with the late Professor Henderson, the ablest and wisest of Hahnemann's supporters in England, that Hahnemann was unfortunate in the exposition of his own views of this subject. But Hahnemann's fine but fundamental theories about the spiritual and dynamic origin of disease are all exploded by the revelations of modern pathology, and their demolition only completes that of his therapeutical theories which rested on them.

Still it does not follow that homœopathy has been of no use. Hahnemann deserves the credit of being the first to break decidedly with the old school of medical practice, in which, forgetful of the teachings of Hippocrates, nature was either overlooked or rudely opposed by wrong and ungentle methods. He was so dissatisfied with this system that he gave up practice. We can scarcely now estimate the force of character and of courage which was implied, eighty years back, in abandoning the common lines of medicine. More than this, he and his followers showed results in the treatment of disease which compared very favorably with the results of orthodox practice. But they entirely missed the right conclusion from their experience. Let us take, for example, the statistics of the treatment of inflammation of the lung (pneumonia), adduced, not by Hahnemann—for it is one of his very weak points that he did not record cases—but, after his death, by Doctor Fleischmann of Vienna. Doctor Henderson quotes these and other homœopathic statistics with great satisfaction, and undoubtedly and properly they produced a great effect, showing a mortality of one in twenty-one cases only, which was a much higher percentage of success than under the ordinary treatment. But these statistics have since been entirely eclipsed by the minute and historical record of cases treated in the Edinburgh Infirmary, where the late Dr. Hughes Bennett treated 105 cases of acute pneumonia, extending over sixteen years, without one death. Still we must admit that Fleischmann's results were greatly better than the old ones, and that but for the homœopathic practice, which most

practitioners regarded as a negation, tantamount to leaving the disease to nature, the emancipation from traditional methods of treatment would have been much slower than it was.

Besides this, homœopathy may be credited with two other services. It has given prominence to the therapeutical side of medicine, and has done much to stimulate the study of the physiological action of drugs. No doubt Hahnemann completely erred in despising nature, and in magnifying medicines in the cure of disease. But his very methods showed, unintentionally on his part, what nature could do; and his devotion and that of his school to therapeutics has acted as a somewhat deserved rebuke to those physicians who get so absorbed in the study of disease as to forget that the great interest of mankind in it is to have it cured with as little delay as possible. It may be admitted that homœopathy has done some service in directing more special attention to various powerful drugs, such as aconite, nux vomica, belladonna, and to the advantage of giving them in simpler forms than were common before the days of Hahnemann.

HONDA, or **SAN BARTOLOMEO DE HONDA**, a town of the republic of Colombia, in the State of Cundinamarca, on the left bank of the river Magdalena, about 575 miles from the sea.

HONDECOETER, **MELCHIOR D'**, painter, was born at Utrecht, it is said, about 1636, and died at Amsterdam, April 3, 1695.

HONDURAS is a republic of Central America, lying north of Nicaragua, east and southeast of San Salvador and Guatemala, and south and west of the bay of Honduras and the Caribbean sea. It lies entirely within the tropics, extends from 83° to 89° W. longitude, and has an area estimated at from 40,000 to 48,000 square miles, and a seacoast of 400 miles. The country is very mountainous, the main range of the Cordilleras traversing the state from northwest to southeast, but it includes many fertile valleys and elevated plains. The rivers are numerous and some in part navigable. There is only one lake of any importance, that of Taulébe. The bay of Fonseca contains several fine ports and includes a number of islands, which are included in Honduras. The country was discovered by Columbus on his fourth voyage in 1502, and it was at Cabo de Honduras that the great navigator first set foot on the continent of America. Cortez led an expedition into it twenty years later, and up to 1823 the country was held by Spain. It revolted and joined the Central American Union in that year, but in 1839 became independent. Troubles with Guatemala followed, and peace was not concluded until 1856. Honduras adopted a new constitution in 1865, and is now governed by a president, senate and chamber of deputies, much after the style of the United States. The country is rich in minerals, particularly silver and copper, but mining is carried on in a very primitive fashion. Timber is abundant on the hills, and mahogany forms one of the principal exports. Wheat, barley, indigo, cotton, coffee, and all the products of the tropical and temperate zones grow luxuriantly. The people, largely of the aboriginal Indian type, are supposed to number some 400,000, but no approach to an accurate census has been made. The prevailing religion is Roman Catholic, but there are many Indian settlements where the Christian religion is unknown. Comayagua, with a population of 10,000, is the capital, and there are very few towns. The republic has a public debt of about \$30,000,000, on which it has omitted to pay the interest for a good many years. There is a small narrow-gauge railroad to San Pedro.

Minerals.—In respect to mineral resources, Honduras ranks first among the states of Central America; the

working of the mines, however, has been conducted on a very small scale, and in a very rude manner, and as a consequence most of them have been abandoned and have filled with water, and have thus or otherwise been allowed to go to ruin. Silver ores are most abundant and valuable. They are chiefly found on the Pacific ranges or groups of mountains, while the gold washings, if not the gold mines proper, are most numerous on the Atlantic slope. The silver is found in various combinations with iron, lead and copper, and in a few instances with antimony. Chlorides of silver are not uncommon, and rank among the richest ores in the country. The principal supply of gold is from the washings of Olancho, which are exceedingly productive. There are also rich mines of copper, the ores, in all cases, containing a considerable proportion of silver. Iron ores are common, most of them magnetic, and some so rich that they can be worked without smelting. Antimony, zinc, and tin also exist. Lignite has been discovered in various localities, and large beds exist in the department of Gracias, in which opals are also abundant.

Animals.—The domestic animals of the country are much the same as those of England and the United States. Cattle are everywhere abundant, and form one of the great sources of wealth in the country. Of late great numbers have been taken to Cuba, where there is a large and increasing demand for them. The forests are frequented by the ocelot or American tiger, and the peccary and deer; the tapir is found near the sea, and the manatee in the northern creeks. Monkeys are numerous and of many varieties; the raccoon, squirrel, opossum, ant-eater, and armadillo abound. The alligator is found in all the rivers and lagoons on both coasts. Of lizards there are numberless varieties, including the iguana. Serpents are very rare, and of but two or three varieties, of which one only is venomous. Tortoise and turtle are everywhere numerous, and of several kinds. Oysters of two varieties are plentiful, namely, the bank and mangrove oyster. Vast beds of the first are found in the Bay of Fonseca.

Inhabitants.—The inhabitants of Honduras are principally of the Indian or aboriginal type. In the eastern portion of the state, between the Rio Roman and Cape Gracias á Dios and Segovia river, the country is almost exclusively occupied by native Indian tribes, known under the general names of Xicaques and Poyas. Portions of all these tribes have accepted the Catholic religion, and live in peaceful neighborhood and good understanding with the white inhabitants. There are, however, considerable numbers who live among the mountains, and still conform closely to the aboriginal modes of life. They all cultivate the soil, and are good and industrious laborers. A small portion of the coast, above Cape Gracias, is occupied by the Sambos, a mixed race of Indians and negroes, which, however, is fast disappearing. Spreading along the entire north coast are the Caribs, a vigorous race, descendants of the Caribs of St. Vincent, one of the Windward Islands, who were deported in 1796, by the English, to the number of 5,000, and landed on the island of Roatan. They still retain their native language, and are active, industrious and provident, forming the chief reliance of the mahogany cutters on the coast. A portion of them, who have a mixture of negro blood, are called the Black Caribs. The bulk of the Spanish population exists on the Pacific slope of the continent, while on the Atlantic declivity the country is uninhabited or but sparsely occupied by Indian tribes, of which the number is wholly unknown. Nevertheless, from the imperfect data which are accessible, the population of Honduras may fairly be estimated at about 400,000,

6,000 to 7,000 being whites, and the balance Indians and the mixed races.

HONDURAS, BRITISH, otherwise known as BELIZE, is a British colony on the peninsula of Yucatan, with an area of about 8,000 square miles. Its climate is not unhealthy, although the rainfall is very great. The population is less than 30,000, mostly negroes and half-breeds. Belize, the capital, has 6,000 inhabitants and is a place of considerable trade. Mahogany and logwood are the principal articles of export.

HONE. Under the name of hones, whetstones, or sharpening stones, a variety of finely silicious stones are employed for whetting or sharpening edge tools, and for abrading steel and other hard surfaces. They generally are prepared in the form of flat slabs or small pencils or rods of the material, but some are made with the outline of the special instrument they are designed to sharpen. Their abrading action is due to the quartz or silica which is always present in predominating proportion, some kinds consisting of almost pure quartz, while in others the silicious element is very intimately mixed with aluminous or calcareous matter, forming a uniform, compact stone, the extremely fine silicious particles of which impart a remarkably keen edge to the instruments for the sharpening of which they are applied.

HONE, WILLIAM (1780–1842), a political satirist and a writer on antiquarian and miscellaneous subjects, was born at Bath, June 3, 1780, and died in 1842.

HONESDALE, a Pennsylvania town, lies on the Lackawaxen river, in Wayne county. It has some manufactures — glass, machinery, and cloth fabrics — and is a railroad, telegraph, and banking town. Its population numbers (1890) about 6,300.

HONEY, a sweet viscid liquid, obtained by bees chiefly from the nectaries of flowers, *i.e.*, those parts of flowers specially constructed for the elaboration of honey, and after transportation to the hive in the proventriculus or crop of the insects, discharged by them into the cells prepared for its reception. Whether the nectar undergoes any alteration within the crop of the bee is a point on which authors have differed. The abdomen in these insects, owing to the distensibility of the membrane connecting its segments, becomes converted into a globular thin-walled sac by the accumulation within it of the nectar supplied to them by their working comrades. By the Rev. H. C. McCook, who discovered the insect in the Garden of the Gods, Colorado, the honey-bearers were found hanging by their feet in groups of about thirty, to the roofs of special chambers in their underground nests, their large globular abdomens causing them to resemble “bunches of small Delaware grapes.”

It is the popular saying that where is the best honey there also is the best wool; and a pastoral district, since it affords a greater profusion of flowers, is superior for the production of honey to one under tillage. Dry, warm weather is that most favorable to the secretion of nectar by flowers. The origin of the honey-yielding properties manifested specially by flowers among the several parts of plants has been carefully considered by Darwin, who regards the saccharine matter in nectar as a waste product of chemical changes in the sap, which, when it happened to be excreted within the envelopes of flowers, was utilized for the important object of cross-fertilization, and subsequently was much increased in quantity, and stored in various ways. It has been noted with respect to the nectar of the fuchsia that it is most abundant when the anthers are about to dehisce, and absent in the unexpanded flower.

The term “virgin-honey” is applied to the honey of young bees which have never swarmed, or to that which flows spontaneously from honeycomb with or without

the application of heat. The honey obtained from old hives, considered inferior to it in quality, is ordinarily darker, thicker, and less pleasant in taste and odor. The yield of honey is less in proportion to weight in old than in young or virgin combs.

So rapid of late years has been the development of bee-keeping in the United States, that the taking of steps to secure the fullest and most accurate details with respect to that industry has been deemed necessary by the commissioners of agriculture. It has been estimated by several intelligent bee-keepers that there are in the United States 700,000 hives of bees, owned by 35,000 people, of whom at least 30,000 are farmers possessing on an average not more than three hives each, the remaining 5,000 being professional apiarians. Mr. G. M. Doolittle, of Borodino, N. Y., on the Auburn branch of the New York Central Railway, obtained an average of 100 pounds of honey apiece from his hives, and from one of them the exceptionally large yield of 700 pounds. It is not unreasonable to say that the hives in the United States afford each a net supply of about 50 pounds of surplus honey, which, selling at 20 cents (10d.) per pound, returns a good profit to the owners. All American honey is classed by the apiculturist according to the plants from which it is derived. It is only in rare cases that pasturage is specially cultivated for the bees. In the States east of the Rocky Mountains there are three chief sources of honey. Those which yield the most delicately flavored and whitest and therefore most valuable commodity (see above) are, first, the immense forests of basswood, the honey from which has perhaps a slight minty flavor, and, secondly, white clover grass, cultivated throughout the States for hay and stock pasture, which furnishes a honey pronounced by competent judges superior to that of the world-renowned Hymettus. Bees having access to both basswood and white clover frequently store the honey from each in the same cells. The third and often richest source of supply is buckwheat, which blossoms after the basswood and white clover have ceased to yield. The pungent honey obtained therefrom, though by its dark color rendered unsuitable for the table, is greatly valued for manufacturing purposes, more especially in the brewing of fine beer, since it forms a perfectly clear solution, ferments well, and is richer in saccharine matter than the glucose commonly employed by brewers, which moreover is apt to be contaminated with the acids employed in its preparation. Buckwheat honey is also accounted a good remedy in bronchial affections, and is therefore in request for the making of cough mixtures. The day is probably not far distant when the refining of the large quantities of dark honey which are harvested will be undertaken on an extensive scale.

For the successful prosecution of bee-keeping energy and perseverance, as well as experience and considerable capital, are requisite. There are several large apiaries in the United States, those of California being probably the largest in the world. The Californian honey, owing to the innocuous nature of the flowers, from which it is procured, is devoid of the colic-producing properties ascribed to some other varieties of honey. Active operations begin in February, and in March or April the bees swarm. The taking of the honey commences usually about May 20th. From the early part of August till as late as October the flowers provide no more honey than is just sufficient for the subsistence of the bees. When October has begun, though the air is still mild, the bees cease to work, becoming semi-dormant, except for an hour or two every eight or ten days, when they fly near their hives in the sunshine. The fact that honey until the middle of the sixteenth

century was the only sweet in general use, and that the aggregate annual consumption of sugar is now from 2,000,000 to 2,500,000 of tons, points to the conclusion that apiculture, if skillfully and extensively conducted, might ere long become productive of results of very high importance to commerce.

HONEY-EATER, or HONEY-SUCKER, names applied by many writers in a very loose way to a large number of birds, some of which, perhaps, have no intimate affinity; but here used in a more restricted sense for what, in the opinion of a good many recent authorities, should really be deemed the Family *Meliphagidæ*—excluding therefrom the *Nectariniidæ* or SUN-BIRDS (which see), as well as the genera *Promerops* and *Zosterops* with whatever allies they may possess.

HONEY-GUIDE, a bird so called from its habit or supposed habit of pointing out to man and to the ratel the nests of bees. Stories to this effect have been often told, and may be found in the narratives of many African travelers, from Bruce to Livingstone.

HONEY-SUCKLE, a genus of climbing, erect, or prostrate shrubs, of the natural order *Caprifoliaceæ*, so named after the German botanist Adam Lonicer. The British species are *L. Periclymenum*, the woodbine, *L. Caprifolium*, and *L. Xylosteum*. Some of the garden varieties of the woodbine are very beautiful, and are held in high esteem for their delicious fragrance; even the wild plant, with its pale flowers, compensating for its sickly looks "with never-cloying odors." The North American sub-evergreen *L. sempervirens*, with its fine heads of blossoms, commonly called the trumpet honey-suckle, is a distinct and beautiful species producing both scarlet and yellow flowered varieties, and the Japanese *L. brachypoda aureo-reticulata* is esteemed for its charmingly variegated leaves.

HONFLEUR, a town of France, at the head of a canton in the arrondissement of Pont l'Évêque in the department of Calvados, is situated on the south side of the estuary of the Seine directly opposite Havre, and about ten miles to the north of Pont l'Évêque and thirty-seven miles to the northeast of Caen.

HONG-KONG, properly HIANG-KIANG (the place of "sweet streams"), an important British island-possession, situated off the southeast coast of China, opposite the province of Kwang-tung, on the east side of the estuary of the Chu-Kiang or Canton river, thirty-eight miles east of Macao and seventy-five southeast of Canton. It is one of a small cluster named by the Portuguese "Ladrones" or Thieves, on account of the notorious habits of their old inhabitants. Extremely irregular in outline, it has an area of twenty-nine square miles, measuring ten and one-half miles in extreme length from northeast to southwest, and varying in breadth from two to five miles. From the mainland it is separated by a narrow channel, which at Hong-Kong roads, between Victoria, the island capital, and Kaulung Point, is about one mile broad, and which narrows at Ly-ce-moon Pass to little over a quarter of a mile. The southern coast in particular is deeply indented; and there two bold peninsulas, extending for several miles into the sea, form two capacious natural harbors, namely, Deep Water Bay, with the village of Stanley to the east, and Tytam Bay, which has a safe, well-protected entrance showing a depth of from ten to sixteen fathoms. An in-shore island on the west coast, called Aberdeen or Taplichan, affords protection to the Shekpywan or Aberdeen harbor, an inlet provided with a granite graving dock, the caisson gate of which is sixty feet wide, and the Hope dock, opened in 1867, with a length of 425 feet and a depth of 24 feet. Opposite the same part of the coast, but nearly two miles distant, rises the largest of the surrounding islands, the

Lamma, whose conspicuous peak, Mount Stenhouse, attains a height of 1,140 feet, and is a landmark for local navigation. On the northern shore of Hong-Kong there is a patent slip at East or Matheson Point, which is serviceable during the northeast monsoon, when sailing vessels frequently approach Victoria through the Ly-ce-moon Pass. The ordinary course for such vessels is from the westward, on which side they are sheltered by Green Island and Kellett Bank. There is good anchorage throughout the entire channel separating the island from the mainland, except in the Ly-ce-moon Pass, where the water is deep; the best anchorage is in Hong-Kong roads, in front of Victoria, where, over good holding ground, the depth is five to nine fathoms. The inner anchorage of Victoria Bay, about half a mile off shore and out of the strength of the tide, is six to seven fathoms. Victoria, the seat alike of government and of trade, is the chief center of population, but in recent years a tract of five square miles on the mainland has been covered with public buildings and villa residences. Practically an outlying suburb to Victoria, Kau-lung (Nine Dragons), or as it is commonly called Kowloon, is free from the extreme heat of the capital, being exposed to the southwest monsoon. Numerous villas have also been erected along the beautiful western coast of the island, while Stanley, in the south, has lately been attracting attention by its excellent qualifications as a watering-place.

HONITON, a municipal borough and market-town of England, county of Devon, is pleasantly situated on a rising ground on the left bank of the Otter and on the London and South-Western railway, sixteen miles east-northeast of Exeter.

HONOLULU. See HAWAIIAN ISLANDS.

HONORIUS, FLAVIUS AUGUSTUS, was emperor of the West from 397 to 425 A.D. His reign of twenty-eight years was one of the most eventful in the Roman annals; the weakness and timidity of the emperor coöperated with the attacks of the Goths and Vandals in promoting the rapid disintegration of the empire. But his influence on the current of events was purely negative.

HONORIUS I., pope from 625 to 638, succeeded Boniface V. The festival of the Elevation of the Cross is said to have been instituted during his pontificate, which was marked also by considerable missionary enterprise. Honorius in his lifetime had favored the formula proposed by the emperor Heraclius, with the design of bringing about a reconciliation between the Monophysites and the Catholics, which bore that Christ had accomplished His work of redemption by one manifestation of His will as the God-man. For this he was, more than forty years after his death, anathematized by name along with the other Monothelite heretics by the council of Constantinople in 680; and this condemnation was subsequently confirmed by more than one pope, particularly by Leo II., as has been abundantly proved by unimpeachable evidence against the contentions of Baronius and Bellarmine. Honorius I. was succeeded by Severinus.

HONORIUS II. (Lambert of Ostia), pope from 1124 to 1130, succeeded Calixtus II. As papal legate he had been one of the framers of the concordat of Worms (1122). During his pontificate the Præmonstratensian order, and also that of the Knights Templar, received papal sanction. His successor was Innocent II.

HONORIUS III., pope from 1216 to 1227, was the successor of Innocent III., whose uncompromising policy in the struggle between the papacy and the empire he had not firmness and vigor to continue. He consented to crown Frederick II. as Holy Roman em-

peror in 1220, although the engagements made with his predecessor had not been fulfilled; the promises which he himself had exacted he was somewhat slow to urge, and it was left to his successor, Gregory IX., to insist upon their accomplishment. He gave papal sanction to the Dominican order in 1216, and to the Franciscan in 1223; and during his pontificate also many of the tertiary orders first came into existence.

HONORIUS IV. succeeded Martin IV., and was pope for two years (1285-1287). After an uneventful pontificate he was succeeded by Nicholas IV.

HONTHEIM, JOHANN NIKOLAUS VON (1701-1790), a zealous opponent of Ultramontanism, was born at Treves, January 27, 1701. He died at Montquintin, Luxembourg, September 2, 1790.

HONTHORST, GERARD VAN (born at Utrecht 1590, died at Utrecht 1656), was brought up as a painter at the school of Bloemart, who exchanged the style of the Franckens for that of the pseudo-Italians at the beginning of the sixteenth century. His most attractive pieces are those in which he cultivates the style of Caravaggio, those, namely, which represent taverns, with players, singers, and eaters. He shows great skill in reproducing scenes illuminated by a single candle.

HOOCH, PIETER DE, a Dutch painter of note, was born, it is thought, about 1632, and died, it is supposed, in 1681 in Haarlem.

HOO-CHOW-FOO, a city of China, in the province of Che-Keang, lies a little to the south of Lake Tai-hoo, in the midst of the central silk district.

HOOD, ROBIN. See ROBIN HOOD.

HOOD, THOMAS (1789-1845), humorist and poet, born May 23, 1789, was the son of Mr. Hood, bookseller, of the firm of Vernor & Hood, a man of intelligence, and the author of two novels.

In 1821 Mr. John Scott, the editor of the *London Magazine*, was killed in a duel, and that periodical passed into the hands of some friends of Hood, who proposed to him to take a part in its publication. His installation into this congenial post at once introduced him to the best literary society of the time; and in becoming the associate of such men as Charles Lamb, Cary, De Quincey, Allan Cunningham, Proctor, Talfourd, Hartley Coleridge, the peasant-poet Clare, and other contributors to that remarkable miscellany, he gradually developed his own intellectual powers, and enjoyed that happy intercourse with superior minds for which his cordial and genial character was so well adapted, and which he has described in his best manner in several chapters of *Hood's Own. Odes and Addresses*—his first work—were written about this time, in conjunction with his brother-in-law, Mr. J. H. Reynolds, the friend of Keats; and it is agreeable to find Sir Walter Scott acknowledging the gift of the work with no formal expressions of gratification, but "wishing the unknown author good health, good fortune, and whatever other good things can best support and encourage his lively vein of inoffensive and humorous satire." *Whims and Oddities, National Tales, Tylney Hall*, a novel, and *The Plea of the Midsummer Fairies* followed. In these works the humorous faculty not only predominated, but expressed itself with a freshness, originality, and power which the poetical element could not claim. He started a magazine in his own name, for which he secured the assistance of many literary men of reputation and authority, but which was mainly sustained by his own intellectual activity. From a sick-bed, from which he never rose, he conducted this work with surprising energy, and there composed those poems, too few in number, but immortal in the English language, such as the *Song of the Shirt*, the *Bridge of Sig*h:

and the *Song of the Laborer*, which seized the deep human interests of the time, and transported them from the ground of social philosophy into the loftier domain of the imagination. Prolonged illness brought on straitened circumstances; and application was made to Sir Robert Peel to place Hood's name on the pension list with which the British state so moderately rewards the national services of literary men. This was done readily and without delay, and the pension was continued to his wife and family after his death, which occurred on May 3, 1845.

HOOD, TOM, son of Thomas Hood, and the inheritor of similar, though less brilliant, literary talents, was born at Lake House, Wanstead, January 19, 1835. He died November 20, 1874.

HOOD, SAMUEL HOOD, FIRST VISCOUNT, English admiral, was born in 1724, at Butleigh, in Somersetshire. For distinguished services in the American and French Revolutionary wars he was raised to the English peerage, with the title of Viscount Hood of Whitley. In 1799 he was promoted to the rank of admiral, and in 1804 he received the grand cross of the Bath. He died at Bath, June 27, 1816.

HOOFES. The healthy soundness of the horse's foot is mainly preserved by permitting it to grow uninjured by the rasp and knife, while its toughness is secured, and undue dryness and evaporation prevented, by smearing daily the crust, sole and frog with a little glycerine, or a mixture made by melting together a quarter of a pound each of tar, honey, beeswax, and glycerine, with a pound of lard. Softness and brittleness of the hoof, which are fruitful sources of cracks and corns, may be remedied by the use of such dressings, by placing the feet for several hours daily in thick, woolen swabs, kept cool and moist by frequent applications of cold water, and by encouraging a more healthy growth of horn by occasional mild blisters round the coronary band. Cracks, or sand-cracks, as they are termed, mostly occur among horses much upon the road, cause lameness and unsoundness.

HOOFT, PIETER CORNELISSEN, Dutch poet and historian, was born at Amsterdam, March 16, 1551, and died in 1647.

HOOGVEEN, a village and commune of the Netherlands, in the province of Drenthe, about twelve miles northeast of Meppel, on the railway opened in 1870 between that town and Groningen.

HOOGHLY. The Hooghly river is the most westerly and commercially the most important channel by which the Ganges enters the Bay of Bengal. It takes its distinctive name near the town of Santipur, about 120 miles from the sea. The stream now known as the Hooghly represents three western deltaic distributaries of the Ganges—viz., (1) the Bhágirathi, (2) the Jalangi, and (3) part of the Mátábhángá.

HOOGHLY, a British district in the lieutenant-governorship of Bengal. The area, including the magistracy of Howrah, amounted in 1888 to 1,497 square miles. It forms the southeastern portion of the Bardwán division, and is bounded north by the district of Bardwán, east by the Hooghly river, separating it from the districts of Nadiyá and the Twenty-Four Paganás; south by the Rupnáráyan, separating it from Midnapur, and west by the same river, separating it from Midnapur, and by Bardwán district. Population, 1,500,000.

HOOGSTRATEN, SAMUEL DIRKSZ VAN, Dutch artist, was born, it is said, in 1627, at The Hague, and died at Dort, October 19, 1678.

HOOK, THEODORE EDWARD, novelist, dramatist, and improvisatore, was born in London, September 22, 1788. He died August 24, 1841. His writings in great part are of a purely ephemeral character; the less transient, touched though they be with a sparkling fancy,

have long since passed out of favor; while the greatest triumphs of the improvisatore may be said to have been writ in wine. Putting aside, however, his claim to literary greatness, Hook will be remembered as one of the most brilliant, genial, and original figures of Georgian times.

HOOK, WALTER FARQUHAR, was born in London, March 13, 1798. His literary works, which are numerous, attain the limit of their design in advancing some incidental plea or in contributing to the student's resources. He died in 1875.

HOOKE, ROBERT, an original and ingenious experimental philosopher, was born at Freshwater, in the Isle of Wight, July 18, 1635. He died in 1703.

HOOKER, JOSEPH, American general, was born in Old Hadley, Mass., November 13, 1814. He was educated at the Military Academy at West Point, 1833-37, and immediately commissioned second lieutenant in the 1st artillery. In the war with Mexico (1846-48) he served as aide-de-camp and assistant adjutant-general, and was breveted captain, major, and lieutenant-colonel, and commissioned captain for meritorious services in the engagements at Monterey, National Bridge, and Chapultepec. He was transferred with his regiment to California in 1849. In 1853 he resigned his commission and bought a large farm near Sonoma, which he managed successfully till 1858, when he was made superintendent of military roads in Oregon. Upon the opening of hostilities in the civil war of 1861-65, he sacrificed his fine estate and offered his sword to the Federal Government. He was commissioned brigadier-general of volunteers, May 17, 1861, and major-general May 5, 1862. At Williamsburg, May 5th he attacked a strong Confederate position, and for nine hours maintained the fight, inflicting and sustaining heavy loss, and winning the title of "Fighting Joe." He was engaged at Fair Oaks, June 1st, and at Malvern Hill, July 1st, and did signal service at Charles City Cross Roads, June 29th, when his division aided in holding a vital position on the flank of the Union Army, in its noted "change of base." In the campaign of Northern Virginia, under General Pope, August 27 to September 1, 1862, he led his division in the actions at Bristow's Station, Manassas, and Chantilly. In the Maryland campaign, September 6-17 (under General McClellan), he commanded the first corps, and gallantly carried the north pass of South Mountain, opening the way for the advance of the army.

He opened the battle of Antietam on the 14th, and on the following morning was pitted against "Stonewall" Jackson, at the noted "cornfield," where he used his artillery with terrible effect, but received a painful wound, and was borne from the field. He was commissioned brigadier-general in the United States army September 20, 1862, and in the disastrous battle of Fredericksburg, under Burnside, he commanded the center grand division (third and fifth corps). He commanded the army of the Potomac January 26 to June 28, 1863, and, having by a fine strategic movement thrown his army across a turbulent stream in face of the foe, fought a severe battle at Chancellorsville, where he was seriously injured; and, his army being thrown into an unfavorable position by the unexpected giving way of his right wing, he decided to retire. He was relieved at his own request, on June 28th, with the thanks of Congress "for skill, energy, and endurance" in the beginning of the Gettysburg campaign. He commanded the twentieth corps (eleventh and twelfth corps consolidated) in the Atlanta campaign, winning special distinction in the night battle of Wauhatchie, and at Lookout Mountain. For a hundred days, and until the capture of Atlanta, the noise

of battle scarcely ceased, his corps doing signal service at Mill Creek, Resaca, New Hope Church, Pine Mount, Peach Tree Creek, and the siege of Atlanta. He was commissioned brevet-major-general in the United States army, March 13, 1865, and retired from active service at his own request, October 15, 1868. The last years of his life were passed in the neighborhood of New York. He died at Garden City, L. I., October 31, 1879.

HOOKER, RICHARD, author of the *Laws of Ecclesiastical Polity*, was born at Heavitree, near the city of Exeter, about the end of 1553, or beginning of 1554, and died in 1600.

HOOKER, SIR WILLIAM JACKSON, a distinguished English botanist, was born at Norwich, July 6, 1785.

It was mainly by Hooker's exertions that botanists were appointed to the government expeditions. While his works were in progress his herbarium received large and valuable additions from all parts of the globe, and his position as a botanist was thus vastly improved. He received the honor of knighthood from William IV., in 1836, in consideration of his meritorious researches in scientific botany; and, a few years later, in 1841, he was appointed director of the Royal Botanical Gardens of Kew, on the resignation of Mr. Aiton. The attainment of this post had long been the object of his life. The gardens flourished under his administration; the government had confidence in him; and his numerous friends and correspondents took pride in contributing to the scientific needs of his herbarium. From small beginnings the gardens expanded under his direction to 75 acres, with an arboretum of 270 acres; and three museums, enriched with many thousand examples of vegetable products, have been added, forming together, with the magnificent palm-house and conservatories, the most delightful and beautiful resort that the inhabitants of London possess; while his extensive library of reference and admirably arranged herbarium, the greater part of which was presented by Sir William to the country, form a constant attraction to the botanist. He was engaged on the *Synopsis Filicum* with J. G. Baker when an epidemic at Kew brought his valuable life to a close. He died August 12, 1865, in the eighty-first year of his age.

HOOLE, JOHN, translator and dramatist, was born at Moorfields, London, in December, 1727. In 1773 he was promoted to be auditor of Indian accounts, which office he resigned in 1783, and, in 1786, he retired to Abinger, near Dorking, Surrey, where he died April 2, 1803.

HOOVER, JOHN, bishop and martyr, was a native of Somersetshire, and was born about 1495. He was educated at Merton College, Oxford, and after taking his degree of bachelor of arts in 1518 joined the order of Cistercian monks at Gloucester. For a short time he was chaplain to Sir Thomas Arundel, but being warned of the danger to which his Protestant opinions exposed him, he in 1539 made his escape to France. Returning to England shortly afterward, he found that plots were again being laid for his life, and escaped to Ireland disguised as a sailor. In 1549 he returned to England and in 1550 he was presented to the bishopric of Gloucester, but refusing it on account of objections to the oath and vestments, he was summoned before the council, and ultimately was imprisoned for some time in the Fleet, till he intimated that his scruples had been removed. In 1552 he was created bishop of Worcester *in commendam*. On the accession of Mary in the following year he was immediately arrested and sent to the Fleet, and after suffering eighteen months' imprisonment he was on January 29, 1555, tried for heresy and condemned to death. The sentence was carried out on

February 9th, the martyr enduring the agonies of the stake, which on account of the accidental use of green wood were unusually protracted, with great fortitude. Hooper's opinions were more decidedly anti-Romish than those of Cranmer or Ridley, and very nearly identical with those afterward promulgated by the Puritans. He was the author of various sermons and controversial treatises.

HOOPING-COUGH, or WHOOPING-COUGH, an infectious disease of the respiratory mucous membrane, manifesting itself by frequently recurring paroxysms of convulsive coughing accompanied with peculiar sonorous inspirations. It occurs for the most part among children, and only once in a lifetime.

The specific cause of hooping-cough is unknown, but the view which ascribes it to some atmospheric condition appears to derive support from the frequency of this disease as an epidemic; whether, however, that be the presence of a peculiar form of germ, as is held by some, remains as yet undetermined. Although specially a disease of childhood, hooping-cough is by no means limited to that period, but may occur at any time of life, even to old age, should there have been no previous attack. It is most common between the ages of one and four, and is rare after ten.

With respect to the symptoms of hooping-cough, three stages of the disease are recognized, viz., (1) the catarrhal stage, (2) the spasmodic stage, (3) the stage of decline.

The *first stage* is characterized by the ordinary phenomena of a catarrh, with sneezing, watering of the eyes, irritation of the throat, feverishness and cough, but in general there is nothing in the symptoms to indicate that they are to develop into hooping-cough. The catarrhal stage usually lasts from ten to fourteen days. The *second stage* is marked by the abatement of the catarrhal symptoms, but at the same time by increase in the cough, which now occurs in irregular paroxysms both by day and by night. Each paroxysm consists in a series of violent and rapid expiratory coughs, succeeded by a loud sonorous or crowing inspiration — the "whoop." During the coughing efforts the air is driven with great force out of the lungs, and as none can enter the chest the symptoms of impending asphyxia appear. The patient grows deep-red or livid in the face, the eyes appear as if they would burst from their sockets, and suffocation seems imminent till relief is brought by the "whoop" — the louder and more vigorous the better. Occasionally blood bursts from the nose, mouth, and ears, or is extravasated into the conjunctiva of the eyes. A single fit rarely lasts beyond from half to three-quarters of a minute, but after the "whoop" another recurs, and of these a number may come and go for several minutes. The paroxysm ends by the coughing or vomiting up of a viscid tenacious secretion, and usually after this the patient seems comparatively well, or, it may be, somewhat wearied and fretful. The frequency of the paroxysms varies according to the severity of the case, being in some instances only to the extent of one or two in the whole day, while in others there may be several in the course of a single hour. Slight causes serve to bring on the fits of coughing, such as the acts of swallowing, talking, laughing, crying, etc., or they may occur without any apparent exciting cause. In general children come to recognize an impending attack by a feeling of tickling in the throat, and they cling with dread to their mothers or nurses; or take hold of some object near them for support during the paroxysm; but although exhausted by the severe fit of coughing they soon resume their play, apparently little the worse. The attacks are on the whole most severe at night. This stage of the disease usually continues

for thirty to fifty days, but it may be shorter or longer. It is during this time that complications are apt to arise which may become a source of danger greater even than the malady itself. The chief of these are inflammatory affections of the bronchi and lungs, and convulsions, any of which may prove fatal. When, however, the disease progresses favorably, as it usually does, the *third* or *terminal stage* is announced by the less frequent paroxysms of the cough, which generally loses in great measure its "whooping" character. The patient's condition altogether undergoes amendment, and the symptoms disappear in from one to three weeks. It is to be observed, however, that for a long period afterward in any simple catarrh from which the patient suffers the cough often assumes a spasmodic character, which may suggest the erroneous notion that a relapse of the whooping-cough has occurred.

In severe cases it occasionally happens that the disease leaves behind it such structural changes in the lungs (emphysema, etc.), as entail permanent shortness of breathing or a liability to attack of asthma. Further, whooping-cough is well known to be one of those diseases of early life which are apt to give rise to a weakened and vulnerable state of the general health, or to call into activity any inherited morbid tendency, such as that toward consumption.

As regards the treatment of whooping-cough in mild cases, little is necessary beyond keeping the patient warm and carefully attending to the general health. In mild weather the patient may be in the open air. In more severe forms efforts have to be employed to modify the severity of the paroxysms.

Onion syrup (made by macerating moist white sugar and chopped onions), into which a small proportion of syrup ipecac has been mixed is sometimes very efficient, care being taken that the bowels are not too much disturbed. Syrup tolu, oz. 2; ammonium chloride, gr. 30; fluid extract cannabis Indica, gtts. viii., form a good mixture for a child over five years of age; dose, teaspoonful three or four times a day. Opium in any form should be eschewed as it increases the congestion of the mucous membrane and thereby aggravates the cough. Bromide potassium in small doses is of benefit when there is much nervous disturbance, but should only be given under a physician's advice. Minute doses of largely diluted prussic acid are of benefit in assisting the secretions of the mucous membranes, and is probably best administered in the form of almond oil (*amygdalis amoenensis*); this remedy is, however, one which a physician alone should give. Generally speaking the disease is best left to run its own course, change of air often being the best remedy.

HOPOE, a bird long celebrated in literature, and conspicuous by its variegated plumage and its large erectile crest, the *Upupa epops* of naturalists, which is the type of the very peculiar Family *Upupidae*, placed by Professor Huxley in his group *Coccygomorphæ*, but considered by Doctor Murie to deserve separate rank as *Epopomorphæ*. This species has an exceedingly wide range in the Old World, being a regular summer-visitant to the whole of Europe, in some parts of which it is abundant, as well as to Siberia, mostly retiring southward in autumn to winter in equatorial Africa and India, though it would seem to be resident throughout the year in Northeastern Africa and in China.

HOORN, a town of Holland, at the head of an arrondissement in the province of North Holland, twenty miles north-northeast of Amsterdam, and ten miles southwest of Enkhuizen, with which it is connected by the road called De Streek. Population, 10,975.

HOOSIC FALLS, a manufacturing town of New York, lies on the Hoosic river, in Rensselaer county.

It has manufactories of agricultural machinery, iron, etc. It is a banking, railroad, and telegraph town, and has a population numbering (1890) 3,684.

HOP, *Humulus Lupulus*, L., the sole representative of its genus, an herbaceous twining plant, belonging to the natural order *Cannabaceæ*, which is by some botanists included in the larger group called *Urticaceæ* by Endlicher. It is of common occurrence in hedges and thickets in the southern counties of England, but is believed not to be native in Scotland. On the Continent it is distributed from Greece to Scandinavia, and extends through the Caucasus and Central Asia to the Altai Mountains. It is common, but doubtfully indigenous, in the northern and western States of North America, and has been introduced into Brazil, Australia, and the Himalayas.

It is a dioecious perennial plant, producing annually several long twining roughish striated stems which twist from left to right, are often from fifteen to twenty feet long, and climb freely over hedges and bushes. The leaves are stalked, opposite, three-five lobed, and coarsely serrate, and bear a general resemblance to those of the vine, but are, as well as the whole plant, rough to the touch; the upper leaves are sometimes scarcely divided, or quite entire. The stipules are interpetiolar, each consisting of two lateral ones united, or rarely with the tips free. When fresh the gland is seen to be filled with a yellowish or dark brown liquid; this, on drying, contracts in bulk and forms a central mass. The contents of these glands, according to Lerner, are chiefly wax (myricylic palmitate) and resins, one of which is crystalline and unites with bases; with these the bitter acid of hops is present in small proportion. It is to these lupulinic glands that the medicinal properties of the hop are chiefly due.

The cultivation of hops for use in the manufacture of beer dates from an early period. In the eighth and ninth centuries hop gardens, called "humularia" or "humuleta," existed in France and Germany. In the herbarium of Apuleius (1050 A.D.), the hop ("hymele") is said to have been put in the usual drinks of England on account of its good qualities. Until the sixteenth century, however, hops appear to have been grown in a very fitful manner, and to a limited extent, generally only for private consumption; but after the commencement of the seventeenth century the cultivation increased rapidly. At the present time England produces a larger quantity than any other country in Europe.

Hops are cultivated in parts of New England, New York, Oregon, and Michigan, and most of the hops consumed in the United States are supplied by those districts. Although the hop was introduced into America nearly 250 years ago, and its cultivation encouraged by legislative enactments in 1657, it is only about seventy-five years since its culture was commenced on an extensive scale; but from that time the progress has been rapid, and hops have been grown in nearly every State in the Union. As in England, the hop is subject to disease and blight, and in consequence the crop is variable; thus, in 1869, 69,463 bales were exported from New York and none imported, and in 1873 only 315 bales were exported and 20,885 imported. The English cluster and grape hops seem to be most generally cultivated in New York and Wisconsin. Hops are also grown largely in Belgium, Prussia, France, Würtemberg, and central Germany. In 1879 only 7,153 cwts. of hops were exported from England, chiefly to Australia and other British possessions, while 262,765 cwts. were imported, of which 108,306 cwts. were derived from the United States, 63,485 cwts. from Belgium, 50,567 from Germany, 26,796 from Holland, and smaller quantities from France and British North

America. The first packages of hops collected in England often fetch an extravagant price, and are sometimes disposed of with remarkable celerity. The first pocket (*sic*) of hops gathered in 1879 is said to have been picked, dried, sent to London, sold by auction, subjected to hydraulic pressure, packed and banded with iron, covered with three coats of paint, and dispatched to an Indian mail steamer—all within twenty-four hours. The better qualities are usually packed in fine and the inferior in coarse sacking. In Germany two varieties of the hop are distinguished, the August and the autumn hop, the former being preferred.

The stem of the hop abounds in fiber similar to that of hemp and flax, and has been used in Sweden in the production of a strong, durable white cloth. Hitherto it has been usual to steep the stem in water during the whole winter in order to separate the fiber easily. A much quicker process has, however, been patented, by which the fiber can be speedily extracted. This process consists in boiling the stems first for three-quarters of an hour in alkaline lye, and then, after rinsing in water, for the same time in acetic acid; the fiber is thus obtained in a state fit for bleaching. The leaves, stem, and root possess also an astringent property, and their use for tanning purposes was hence at one time patented in England. The leaves have also been recommended as fodder in the fresh state, mixed with other materials, and are said to increase the quantity and improve the quality of milk yielded by cows. The stems or "bine" are usually burned in the hop garden. The spent hops from breweries form excellent manure for light soils, and together with the leaves should be returned to the hop-gardens, the materials absorbed from the ground by the hop-plant being thus in some measure restored to it.

The use of hops in medicine dates from a very early period. Coles, in his *History of Plants* (1657), says: "They are good to cleanse the kidneys of gravel and provoke urine; they likewise open obstructions of the liver and spleen, and cleanse the blood and loosen the belly; and as they cleanse the blood, so consequently they help to cure eruptions of the skin." Brooke's *Dispensatory* (1753) recommends them also as an alterative, and as a remedy for hypochondriasis. Hops are officinal in the British and United States Pharmacopœias. According to Bartholow hops increase the action of the heart, excite the cutaneous circulation, and cause diaphoresis. A slight cerebral excitement is first produced, soon followed by a disposition to sleep. Hops also possess some anaphrodisiac properties. The preparations used are the tincture, infusion, and extract, the oleoresin, and the lupulinic glands. The drug is generally employed either as a stomachic in dyspepsia, or to allay nervous irritability or cerebral excitement in delirium tremens, where the use of opium is inadmissible. A combination of the tinctures of lupulin and capsicum is said to be one of the best substitutes for alcoholic stimulants when their habitual use is to be discontinued. A pillow stuffed with hops forms a well-known domestic remedy for sleeplessness, and a bag of hops dipped in hot water is often used as an external application to relieve pain or inflammation, especially of the abdominal organs.

HOPE, THOMAS, the author of *Anastasius*, born at London about 1770, was descended from a branch of an old Scotch family who for several generations were extensive merchants in London and Amsterdam. Hope died February 3, 1831. He was the author of two works published posthumously,—the *Origin and Prospects of Man*, 1831, in which he indulged in speculations diverging widely from the usual orthodox opinions, and an *Historical Essay on Architecture*, 1835, an

elaborate description of the architecture of the Middle Ages, illustrated by drawings made by himself in Italy and Germany.

HÔPITAL. See L'HÔPITAL.

HOPKINS, EZEKIEL, bishop of Londonderry, and a Calvinistic divine of some repute, was born at Stanford, Devon, in 1633. He died in June, 1690.

HOPKINS, SAMUEL, the theologian from whom the Hopkinsians or Hopkinsian Calvinists take their name, was born at Waterbury, Conn., on September 17, 1721.

While in vigor of intellect and in strength and purity of moral tone hardly inferior to Jonathan Edwards, Hopkins considerably excelled his master in force and energy of character. To him belongs the honor of having been one of the first to stir up and organize political action against slavery; and to his persistent though bitterly opposed efforts are chiefly to be attributed the law of 1774, which forbade the importation of negroes into New England, as also that of 1784, which declared that all children of slaves born after the following March should be free. He was the author of numerous pamphlets, addresses and sermons; and he also published lives of Jonathan Edwards, Susannah Anthony and Mrs. Osborn. But his distinctive theological tenets are chiefly to be sought in his important work, the *System of Theology*, which, published in 1791, has had an influence hardly inferior to that exercised by the writings of Edwards himself. He died in 1803.

HOPKINSON, FRANCIS, an American author, and one of the signers of the Declaration of Independence, was born at Philadelphia in 1737. He studied at the college of Philadelphia, and after graduating in 1763, resolved to prepare himself for the legal profession. After being admitted to the bar in 1765, he spent two years in England, and on his return in 1768 he obtained a lucrative public appointment in New Jersey. In 1776-77 he represented that State in Congress. In 1779 he was appointed judge of admiralty for Pennsylvania, and in 1790 district judge for the same State. He died at Philadelphia, May 9, 1791. Hopkinson was the author of several songs to which he wrote popular airs, and of various political poems, pamphlets and *jeux d'esprit*, which from their humorous satire had a wide circulation, and powerfully assisted in arousing and fostering the spirit of political independence that issued in the American Revolution.

HOPKINSVILLE, the county seat of Christian county, Ky., lies on the Little River. It has manufactories, banks, stores, churches, hotels, a court house and an insane asylum for the State. There are two female and one male colleges here. The town has several newspapers. Population (1890 census), 6,457. It is a railroad and telegraph station.

HOPPNER, JOHN, English portrait painter, was born on April 4, 1758, and died in 1810.

HOR, MOUNT, a lofty and conspicuous double-topped mountain in Arabia Petræa, forming part of the great Jurassic chain of Shera or Seir. It stands on the eastern edge of the great valley of the Arabah, which extends from the head of the Gulf of Akabah to the valley of the Jordan, and it is referred to in Scripture as "on the border," or "at the edge" of the land of Edom.

HORACE, (65-8 B.C.) No ancient writer has been at once so familiarly known and so generally appreciated in modern times as Quintus Horatius Flaccus. We seem to know his tastes and habits, and almost to catch the tones of his conversation, from his own works, as we know the character and manner of Doctor Johnson from the pages of Boswell. His twofold function of a satiric moralist and a lyric poet give a

peculiar value, both to his self-portraiture and to the impressions which he has left of his age. From his *Satires*, which deal chiefly with the manners and outward lives of men, we know him in his relations to society and his ordinary moods; from his *Epistles*, which deal more with the inner life, we best understand his deepest convictions and the practical side of his philosophy; while his *Odes* have perpetuated the finest pleasure which he derived from art, nature, and the intercourse of life, have idealized some of the graver as well as the lighter aspects of his reflection, and given an elevated expression to his sympathy with the national ideas and movement of his time.

His own writings afford much the fullest and most trustworthy materials for his biography and for the estimate of his character. But a few facts, in addition to those recorded by the poet himself, are known from the short life originally contained in the work of Suetonius, *De Viris Illustribus*.

Horace was born December 8, 65 B.C., in the consulship of L. Manlius Torquatus and L. Aurelius Cotta. His birthplace was the town of Venusia on the borders of Lucania and Apulia, whence he describes himself as "Lucanus an Apulus anceps." His father was a freedman by position; and it is supposed that he had been originally a slave of the town of Venusia, and on his emancipation had received the gentile name of Horatius from the Horatian tribe in which the inhabitants of Venusia were enrolled. After his emancipation he acquired by the occupation of "coactor" sufficient means to enable him to buy a small farm, to make sufficient provisions for the future of his son, and to take him to Rome to give him the advantage of the best education there. After the ordinary grammatical and literary training at Rome, Horace went to Athens, the most famous school of philosophy, as Rhodes was of oratory; and he describes himself while there as "searching after truth among the groves of the Academy" as well as advancing in literary accomplishment. His pleasant residence there was interrupted by the breaking out of the civil war. Following the example of his young associates, he attached himself to the cause of Brutus, whom he seems to have accompanied to Asia, probably as a member of his staff; and he served at the battle of Philippi in the post of military tribune. He shared the rout which followed the battle, and in an ode addressed to his old comrade Pompeius Grosphus he alludes, in imitation of a similar confession of Alcæus, to the inglorious casting away of his shield. In interpreting such passages in the works of Horace, we have always to bear in mind the irony habitual to him, and the reserve imposed on him by his subsequent relations to the chiefs of the victorious party.

He returned to Rome shortly after the battle, stripped of his property, which formed part of the land confiscated for the benefit of the soldiers of Octavianus and Antony. It may have been at this time that he encountered the danger of shipwreck, which he mentions among the perils from which his life had been protected by supernatural aid. He procured in some way the post of a clerkship in the *quæstor's* office, and about three years after the battle of Philippi, he was introduced by Virgil and Varius to Mæcenas. This was the turning-point of his fortunes. He owed his friendship with the greatest of literary patrons to his personal merits rather than to his poetic fame; for, though some of his shorter and less important pieces may have been known to a small circle of friends before the date of this introduction, his first published work shows that the relations of intimacy and mutual confidence which were never afterward disturbed had been established between the statesman and poet some time before this book was given to the world.

About a year after the publication of this first book of *Satires* Mæcenas presented him with a farm among the Sabine hills, in the valley crowned by Mount Lucretilis and watered by the stream Digentia, which joins the main valley of the Anio near the modern Vico Varo, and about eight miles above the modern Tivoli. No kind of gift could have added more to the poet's happiness or exercised a more salutary influence on his genius.

The second book of *Satires* was published in 29 B.C., the *Epodes* apparently about a year earlier, though many of them are, as regards the date of their composition, to be ranked among the earliest extant writings of Horace. Horace speaks of them under the name of "iambi." In one of his *Epistles* he rests his first claim to originality on his having introduced into Latium the meters and spirit of Archilochus—

"Parios ego primus iambos
Ostendi Latio, numeros animosque secutus
Archilochi."

The *Epodes* are chiefly interesting as a record of the personal feelings of Horace during the years which immediately followed his return to Rome, and as a prelude to the higher art and inspiration of the first three books of the *Odes*, which were published together about the end of 24 or the beginning of 23 B.C.

About four years after the publication of the three books of *Odes*, the first book of the *Epistles* appeared, introduced, as his *Epodes*, *Satires* and *Odes* had been, by a special address to Mæcenas. From these *Epistles*, as compared with the *Satires*, we gather that he had gradually adopted a more retired and meditative life, and had become fonder of the country and of study, and that, while owing allegiance to no school or sect of philosophy, he was framing for himself a scheme of life, was endeavoring to conform to it, and was bent on inculcating it on others. He maintained his old friendships, and continued to form new intimacies, especially with younger men engaged in public affairs or animated by literary ambition. After the death of Virgil he was recognized as preëminently the greatest living poet and was accordingly called upon by Augustus to compose the sacred hymn for the celebration of the secular games in 17 B.C. About four years later he published the fourth book of *Odes*, having been called upon to do so by the emperor, in order that the victories of his stepsons Drusus and Tiberius over the Rhæti and Vindelici might be worthily celebrated. He lived about five years longer, and during these years published the second book of *Epistles*, and the *Epistle to the Pisos*, more generally known as the "*Ars Poetica*." These later *Epistles* are mainly devoted to literary criticism, with the especial object of vindicating the poetic claims of his own age over those of the age of Ennius and the other poets of Rome. He might have been expected, as a great critic and lawgiver on literature, to have exercised a beneficial influence on the future poetry of his country, and to have applied as much wisdom to the theory of his own art as that of a right life. But his critical *Epistles* are chiefly devoted to a controversial attack on the older writers and to the exposition of the laws of dramatic poetry, on which his own powers had never been exercised, and for which either the genius or circumstances of the Romans were unsuited. The same subordination of imagination and enthusiasm to good sense and sober judgment characterizes his opinions on poetry as on morals.

He died somewhat suddenly in the November of the year 8 B.C., within a few weeks of the death of Mæcenas, thus strangely confirming the declaration made by him in one of his *Odes*. Though not an old man, he had reached the full maturity of his faculties, and fully

accomplished the work he was fitted to do in the world. He lived longer than any of the illustrious poets immediately contemporary with him or belonging to the preceding generation; and his works show a mature character and a mellow wisdom in striking contrast to the tone of the only other great lyrical poet of Rome, "the young Catullus."

HORATII, three brothers born at one birth, who were the champions of Rome in the war against Alba Longa. Three Alban brothers named the Curiatii, likewise born at one birth, were opposed to them. The mothers were also twin sisters, who had been married at the same time, and had given birth to their sons on one day. When the Alban army under their king Cluilius lay encamped some miles from Rome, Tullus Hostilius, the Roman king, agreed with them that the issue should depend on the combat between the two families. Two of the Horatii were soon slain; the third brother feigned flight, and when the Curiatii, who were all wounded, pursued him without concert he turned and slew them one by one. Now the sister of the Horatii was engaged to one of the Curiatii, and had made for him a beautiful mantle. When the victor, adorned with this trophy, was entering Rome in triumph, his sister came to greet him by the Porta Capena; but when the fatal mantle, which he wore as a trophy, showed her that her lover had fallen by her brother's hand, she invoked a curse on him. Enraged at her reproaches, he slew her on the spot; and the body of her that had preferred her lover to her country lay unburied till passers-by covered it with stones. Horatius was condemned by *duumviri*, specially appointed as his judges, to be scourged to death; but his father justified his action, and on appeal the people spared his life, condemning him in penalty to walk with veiled head below the *sororium tigillum*. Horatius was afterward sent to destroy Alba Longa and transport all the inhabitants to Rome. Monuments of the tragic tale were shown by the Romans in the time of Livy—the *pila Horatia* in the forum, where the victor hung his spoils; the beam under which the brother passed, and which stood across a narrow street near the site of the later Flavian Amphitheater; the sister's grave outside the gate; the grave of the two Horatii, and those of the three Curiatii, where each had fallen; the *fossa Cluilia* dug by the Albans to defend their camp.

HORDE, a manufacturing town of Westphalia, Prussia, circle of Dortmund, government district of Arnsberg, is situated on the railway from Dortmund to Soest, two miles southeast from Dortmund.

HOREB. See SINAI.

HOREHOUND, *Marrubium*, L., a genus of perennial, usually cottony or woolly herbs, of the natural order *Labiata*, and tribe *Stachydeæ*. Common or white horehound, *M. vulgare*, L., has a short and stout rootstock, and thick stems, about a foot in height, which, as well as their numerous branches, are coated with a white or hoary felt—whence the popular name of the plant. White horehound contains a volatile oil, resin, a crystallizable bitter principle termed *marrubiin*, and other substances, and has a not unpleasant aromatic odor, and a persistent bitter taste. It possesses expectorant, tonic, and carminative properties, and in large doses is diuretic and laxative; and the infusion, syrup, or confection of horehound has long been in repute for the treatment of coughs and asthma, and has been recommended also in phthisis, chronic rheumatism, hepatic and uterine disorders, hysteria, and chlorosis. For medicinal purposes the plant should be gathered when in flower, and is preferable in the fresh condition.

HORGEN, a village in the Swiss canton of Zurich,

capital of the district of Horgen, is situated on the left bank of the Zurich Lake, 1,500 feet above sea-level, and nine miles south of Zurich.

HORITZ, a town of Bohemia, Austria, government district of Königgrätz, is situated on the right bank of the Bistritz, ten miles northeast from Bidschow.

HORMAYR, JOSEPH, BARON VON, German statesman and historian, was born at Innsbruck, January 20, 1781, and died at Munich, November 5, 1848.

HORMISDAS, pope from 514–523, in succession to Symmachus, was a native of Campania. He was succeeded in 523 by John I. Eighty of his letters are preserved in Labbe's *Sacrosancta Concilia*, vol. v. (1728), and are also to be found in vol. lxiii. of Migne's *Patrologiæ Cursus Completus* (Latin series).

HORN. The weapons which project from the heads of various species of animals, constituting what are known as horns, embrace substances which are, in their anatomical structure and chemical composition, quite distinct from each other; and although in commerce also they are known indiscriminately as horn, their uses are altogether dissimilar. These differences in structure and properties are thus indicated by Professor Owen:—"The weapons to which the term horn is properly or technically applied consist of very different substances, and belong to two organic systems, as distinct from each other as both are from the teeth. Thus the horns of deer consist of bone, and are processes of the frontal bone; those of the giraffe are independent bones or 'epiphyses' covered by hairy skin; those of oxen, sheep and antelopes are 'apophyses' of the frontal bone, covered by the corium and by a sheath of true horny material; those of the prong-horned antelope consist at their basis of bony processes covered by hairy skin, and are covered by horny sheaths in the rest of their extent. They thus combine the character of those of the giraffe and ordinary antelope, together with the expanded and branched form of the antlers of deers. Only the horns of the rhinoceros are composed wholly of horny matter, and this is disposed in longitudinal fibers, so that the horns seem rather to consist of coarse bristles compactly matted together in the form of a more or less elongated sub-compressed cone." True horny matter is really a modified form of epidermic tissue, and consists of an albuminoid principle termed "keratin." It forms, not only the horns of the ox tribe, but also the hoofs, claws or nails of animals generally, the carapace of the tortoises and the armadilloes, the scales of the pangolin, porcupine quills, and birds' feathers, etc.

HORN, or FRENCH HORN, a wind instrument made at various times of various materials such as wood, ivory and several metals, but belonging in its modern significance to the class of brass instruments. The notes natural to the horn and produced by the action of the lips alone are the so-called harmonics or partial tones of the bottom note between the extreme limits of the C below the staff in the base clef to the E in alt. Some of these notes are, however, not used in practice. In order to supply the notes not in the scale of natural harmonics various methods have been used. The simplest is the insertion of the hand in the bell of the instrument, accidentally discovered by a German horn-player toward the end of the last century. The effect is to lower the note by a semitone or a whole tone, according to the extent that the orifice is closed. The drawback attaching to this system is that the "closed" or "stopped" (*étouffé*) notes differ in character from the open ones, and are in part dull. It is true that a good composer may produce certain effects by this means. In the modern horn a mechanical contrivance generally takes the place of the hand. This is the valve or ventil, an apparatus for lowering the note by means of the

pressure of the fingers. There are three valves attached to the vent-horn, lowering the note by one, two and three semitones respectively. Most modern composers write for the vent-horn exclusively; others use it in combination with natural or hand horns. Another important appliance of the horn is the crook, which may best be described as a transposing machine. The crooks can be removed at will, their effect (by altering the length of the tube) being to transpose the notes produced by the lips into anything that is required. The player therefore plays as it were in one and the same key, and the difficulty of transposing his part mentally is saved to him. In consequence the horn part in a score is always written in the key of C, which may be changed into E flat or F or E by merely inserting the crook intended for that key. In this way not only the diatonic scale, but all kinds of chromatic progressions can be produced on the horn.

HORNBEAM, a small genus of trees of the natural order *Cupuliferæ* and sub-order *Coryleæ*. The Latin name *Carpinus* has been thought to be derived from the Celtic *car*, wood, and *pin* or *pen*, head, the wood of hornbeams having been used for yokes of cattle. The common hornbeam, or yoke-elm, is indigenous in the temperate parts of western Asia and of Asia Minor, and in Europe, where it ranges as high as 55° and 56° N. latitude. It is common in woods and hedges in parts of Wales and of the south of England. The trunk is usually flattened, and twisted as though composed of several stems united; the bark is smooth, and light gray; and the leaves are subdistichous, two to three inches long, elliptic-ovate, doubly serrate, pointed, numerous ribbed, hairy below, and opaque, and not glossy as in the beech, have large stipules and short petioles, and when young are plaited. The flowers appear with the leaves in April and May.

The wood of the hornbeam is white and close-grained, and polishes ill, is of considerable tenacity and little flexibility, and is extremely tough and hard to work — whence, according to Gerard, the name of the tree.

HORNBILL, the English name for a long while generally given to all the birds of the Family *Bucerotidæ* of modern ornithologists, from the extraordinary horn-like excrescence (*epithema*) developed on the bill of most of the species, though to which of them it was first applied seems doubtful. Among classical authors Pliny had heard of such animals, and mentions them under the name of *Tragopan*; but he deemed their existence fabulous, comparing them with *Pegasi* and *Gryphones* — in the words of Holland, his translator — “I thinke the same of the Tragopanades, which many men affirme to bee greater than the Ægle; having crooked hornes like a Ram on either side of the head, of the colour of yron, and the head onely red.”

HORNBOOK, a name sometimes given to an elementary treatise on any subject. It was originally applied to a sheet containing the letters of the alphabet, which formed a primer for the use of children. It was mounted on wood and protected with transparent horn. Sometimes the leaf was simply pasted against the slice of horn. The wooden frame had a handle, and it was usually hung at the child's girdle.

HORNCastle, a market-town giving its name to a soke in Lincolnshire, England, is situated at the foot of a line of low hills called the Wolds, on an angle formed by the confluence of the Bain and Waring, and at the terminus of a branch line of the Great Northern Railway. Population, 5,875.

HORNE, GEORGE, bishop of Norwich, was born on November 1, 1730, at Otham near Maidstone. As a preacher he early attained great popularity; and his reputation was further helped by several clever if some-

what wrong-headed publications, including a satirical pamphlet entitled *The Theology and Philosophy of Cicero's Somnium Scipionis* (1751), a defense of the Hutchinsonians in *A Fair, Candid, and Impartial State of the Case between Sir Isaac Newton and Mr. Hutchinson* (1753), and critiques upon Doctor Shuckford (1754) and Doctor Kennicott (1760). He died at Bath, January 17, 1792.

HORNE, THOMAS HARTWELL, a well-known writer on Biblical introduction, was born in London on October 20, 1780, and from 1789–95 was educated at Christ's Hospital, where Coleridge was an elder contemporary. He died in London on January 26, 1862.

HORNELLVILLE, a New York town, lies in Steuben county, on the Canisteo river. It has manufactures of agricultural implements, shoes, boots, leather, etc. There are schools, churches, newspapers, a free high school and a business college here. It is a banking, railroad, and telegraph town, and has a public library and a Catholic convent. Extensive railroad repair shops are also situated here. Population (1890) 10,996.

HORNER, FRANCIS, political economist, was born at Edinburgh, August 12, 1778. He died at Pisa, February 8, 1817. He was buried at Leghorn, and a marble statue by Chantrey was erected to his memory in Westminster Abbey.

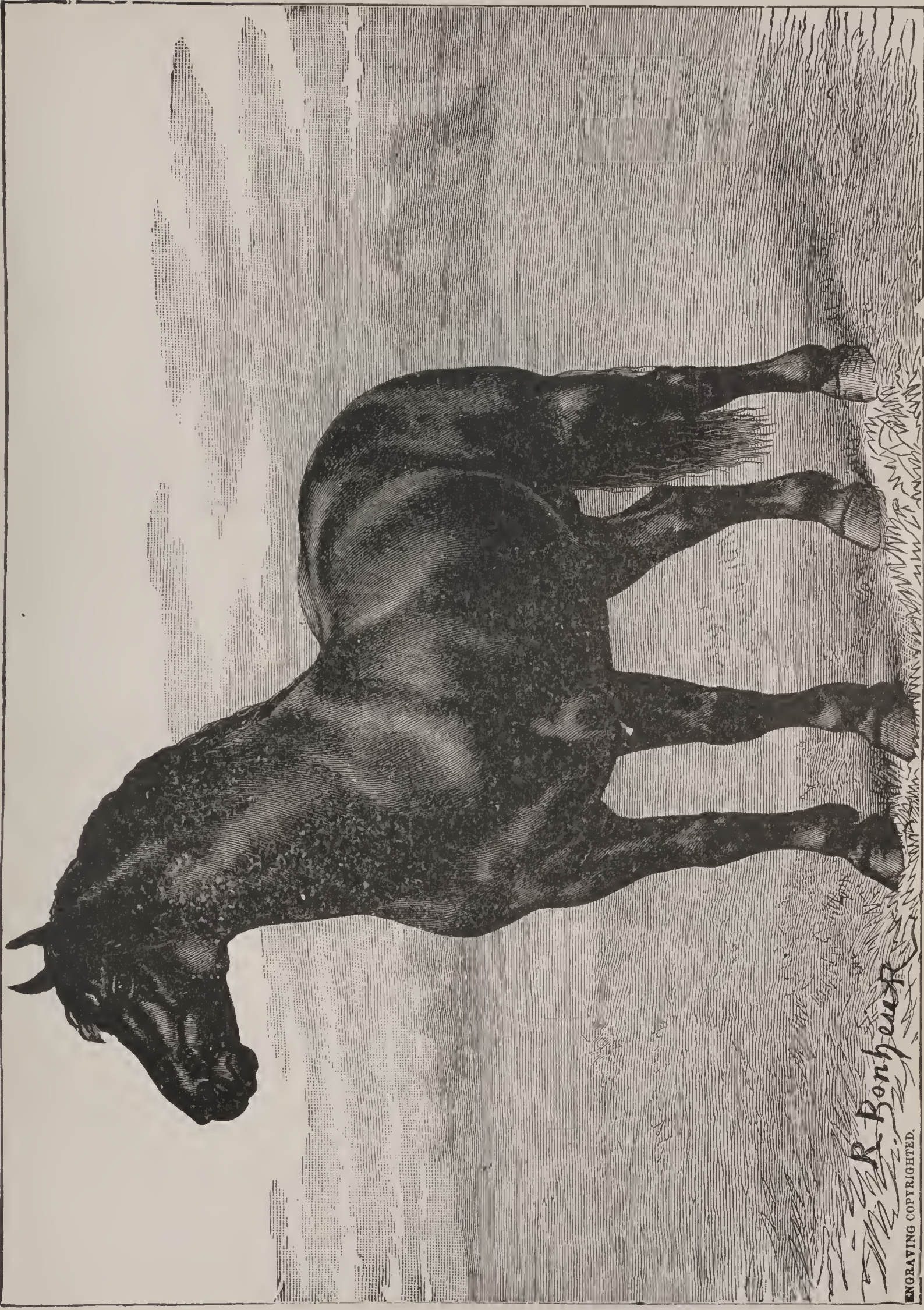
HORNET. See WASP.

HORNPIPE was originally the name of an instrument no longer in existence, and is now used for an English national dance. The sailor's hornpipe, although the most common, is by no means the only form of the dance, for there is a pretty tune known as the “College Hornpipe,” and other specimens of a similar kind might be cited. The composition of hornpipes flourished chiefly in the last century, and even Handel did not disdain to use the characteristic rhythm. The hornpipe may be written in $\frac{3}{2}$ or in common time, and is always of a lively nature.

HORROCKS, JEREMIAH, an astronomer of extraordinary promise, blighted by a premature death, was born in 1619, at Toxteth Park, near Liverpool. His university career lasted three years, and on his return to Lancashire he devoted to astronomical observations the brief intervals of leisure snatched from the harassing occupations of a laborious life. In 1636 he met with a congenial spirit in William Crabtree, a draper of Broughton, near Manchester; and encouraged by his advice he exchanged the guidance of Lansberg, a pretentious but inaccurate Belgian astronomer, for that of Kepler. He now set himself to the revision of the Rudolphine Tables (published by Kepler in 1627), and in the progress of his task became convinced that a transit of Venus overlooked by Kepler, would, nevertheless, occur on November 24 (O.S.), 1639. He was at this time curate at Hoole, near Preston, having recently taken orders in the Church of England, although, according to the received accounts, he had not attained the canonical age. November 24th falling on a Sunday, his clerical duties threatened fatally to clash with his astronomical observations; he was, however, released just in time to witness the punctual verification of his forecast, and carefully noted the progress of the phenomenon during half an hour before sunset (3:15 to 3:45). This transit of Venus is remarkable as the first ever observed, that of 1631, predicted by Kepler, having been invisible in Europe. Notwithstanding the rude character of the apparatus at his disposal, Horrocks was enabled by his observation of it to introduce some important corrections into the elements of the planet's orbit, and to reduce to its exact value the received estimate of its apparent diameter.

After a year spent at Hoole, he returned to Toxteth,

HORSES.



BRILLIANT.

HORSES.



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INDRE

and there, on the eve of a long-promised visit to his friend, Crabtree, unexpectedly expired, January 3, 1641, in the twenty-second year of his age.

HORSE. The horse and its near allies, the several species of asses and zebras, constitute the genus *Equus* of Linnæus, a small group of animals of the class *Mammalia*, so distinct in their organization from all other existing members of the class that in many of the older zoölogical systems they were placed in an order apart, under the name of *Solidungula* or *Monodactyla*.

The remains of the earliest known animals to which it is possible to trace back the modern horse by a series of successive modifications are found in the lowest strata of the great lacustrine formations assigned to the Eocene period, spread over considerable portions of the present territories of New Mexico, Wyoming, and Utah in North America. That similar animals may have existed in other parts of the world is extremely probable.

Fossil remains of true horses, differing but very slightly from the smaller and inferior breeds of those now existing, are found abundantly in deposits of the most recent geological age, in almost every part of America, from Escholtz Bay in the north to Patagonia in the south. In that continent, however, they became quite extinct, and no horses, either wild or domesticated, existed there at the time of the Spanish conquest, which is the more remarkable as, when introduced from Europe, the horses that ran wild proved by their rapid multiplication in the plains of South America and Texas that the climate, food, and other circumstances were highly favorable for their existence. The former great abundance of *Equidae* in America, their complete extinction, and their perfect acclimatization when reintroduced by man, form curious but as yet unsolved problems in geographical distribution.

The existing species of the genus *Equus* are the following:

(1.) The Horse, *Equus caballus*, Linn., is distinguished from the others by the long hairs of the tail being more abundant and growing quite from the base as well as the end and sides, and also by possessing a small bare callosity on the inner side of the hind leg, just below the "hock" or heel joint, in addition to the one on the inner side of the forearm above the carpus, common to all the genus. The mane is also longer and more flowing, and the ears shorter, the limbs longer, and the head smaller.

Though the existing horses are usually not marked in any definite manner, or only irregularly dappled or spotted with light surrounded by a darker ring, many examples are met with showing a dark median dorsal streak like that found in all other members of the genus, and even with dark stripes on the shoulders and legs indicating "the probability of the descent of all the existing races from a single dun-colored, more or less striped, primitive stock, to which our horses still occasionally revert."

In Europe wild horses were extremely abundant in the Neolithic or polished-stone period. Judging from the quantity of their remains found associated with those of the men of that time, the chase of these animals must have been among his chief occupations, and they must have furnished him with one of his most important food supplies. The characters of the bones preserved, and certain rude but graphic representations carved on bones or reindeers' antlers, enable us to know that they were rather small in size, and heavy in build, with large heads and rough and shaggy manes and tails, much like, in fact, the present wild horses of the steppes of the south of Russia. These horses were domesticated by the inhabitants of Europe before the dawn of history, but it is doubtful whether the majority of the animals

now existing on the Continent are derived directly from them, as it is more probable that they are descendants from horses imported through Greece and Italy from Asia, derived from a still earlier domestication, followed by gradual improvement through long-continued attention bestowed on their breeding and training. Horses are now diffused by the agency of man throughout almost the whole of the inhabited parts of the globe, and the great modifications they have undergone in consequence of domestication and selective breeding are well exemplified by comparing such extreme forms as the Shetland pony, dwarfed by congenial climate, the thoroughbred racer, and the dray-horse. In Australia, as in America, horses imported by the European settlers have escaped into the unreclaimed lands, and multiplied to a prodigious extent, roaming in vast herds over the plains where no hoofed animal ever trod before.

(2.) *Equus asinus*, Linn.—The Domestic Ass is nearly as widely diffused and useful to man as the horse. It was known in Egypt long before the horse, and is probably of African origin, indeed its close resemblance to the existing wild ass of Abyssinia, *E. taniopus*, Heuglin, leaves little doubt as to its identity with that species.

(3.) The Asiatic Wild Asses, which roam in small herds in the open plains of Syria, of many parts of Persia, of the northwest of India, and the highlands of Tartary and Tibet from the shores of the Caspian to the frontiers of China, differ from the last in being of a more rufous or isabelline color, instead of pure gray, in wanting the dark streak across the shoulder, and having smaller ears. They have all a dark-colored median dorsal stripe. Though it is considered probable by many zoölogists that they form but a single species, they present such marked variations in size and form that they have commonly been divided into three—the Syrian Wild Ass, the Onager from Persia, the Punjab, Scinde and the desert of Cutch, and the Kiang or Dzeggetai of the high table-lands of Tibet, where it is usually met with at an elevation of 15,000 feet and upward above the sea-level. The last is considerably larger than either of the others, and differs from them in external appearance, having more the aspect of the horse. They are all remarkably swift, having been known to outstrip the fleetest horse in speed.

Lastly, there are three striped species, all inhabitants of South Africa. These constitute the genus *Hippotigris* of Hamilton Smith, but they are not separable except by their coloration from the true asses, and one of them (4), the Quagga, may be considered as intermediate. This animal has the dark stripes limited to the head, neck and shoulders, upon a brown ground. In (5) the Dauw or Burchell's Zebra, the ground color is white, and the stripes cover the body and upper part of the limbs. This is the commonest species in the great plains of South Africa, where it roams in large herds, often in company with the quagga and numerous species of antelope. It ranges from the Orange River to the confines of Abyssinia. In (6) the Mountain Zebra the contrast between the clear white of the ground and the black of the stripes is most marked, and the latter extend quite down to the hoofs. This is, consequently, the most beautiful species of the group as regards color, if the horse may bear the palm in elegance of form. It frequents mountainous districts rather than the open plains which are the dwelling-places of the other two species, and as it appears to be limited to the southern portion of the continent, within the confines of the Cape Colony, its members are rapidly diminishing under the encroachments of European civilization.

There are thus at least six modifications of the horse

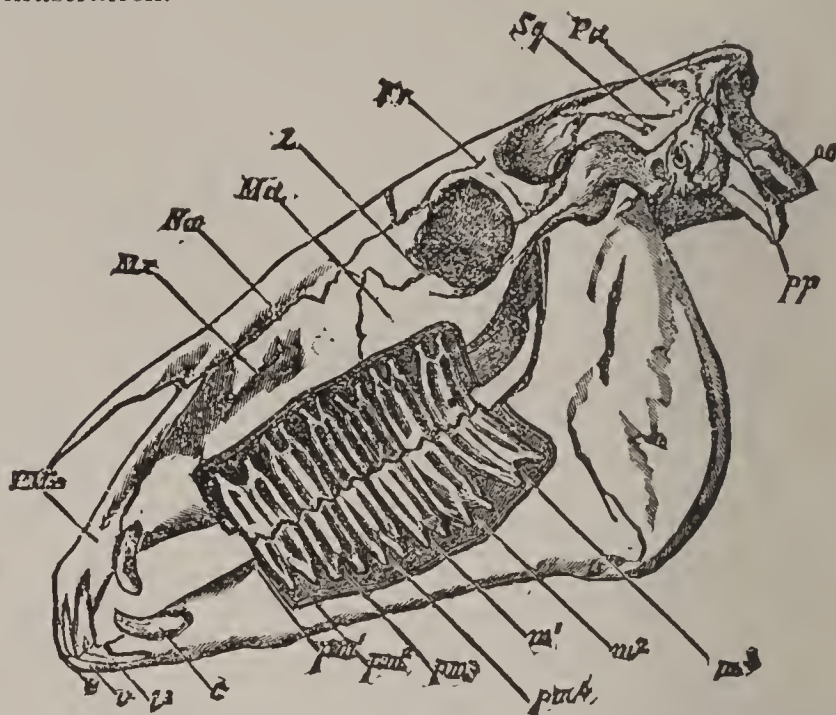
type at present existing, sufficiently distinct to be reckoned as species by all zoölogists, and easily recognized by their external characters. They are, however, all so closely allied that each will, at least in a state of domestication or captivity, breed with perfect freedom with any of the others. Cases of fertile union are recorded between the horse and the quagga, the horse and the dauw or Burchell's zebra, the horse and the hemionus or Asiatic wild ass, the common ass and the zebra, the common ass and the dauw, the common ass and the hemionus, the hemionus and the zebra, and the hemionus and the dauw. The two species which are perhaps the farthest removed in general structure, the horse and the ass, produce, as is well known, hybrids or mules, which in some qualities useful to man excel both their progenitors, and in some countries and for certain kinds of work are in greater requisition than either. Although occasional instances have been recorded of female mules breeding with the males of one or other of the pure species, it is doubtful if any case has occurred of their breeding *inter se*, although the opportunities of doing so must have been great, as mules have been reared in immense numbers for at least several thousands of years. We may therefore consider it settled that the different species of the group are now in that degree of physiological differentiation which enables them to produce offspring with each other, but does not permit of the progeny continuing the race, at all events unless reinforced by the aid of one of the pure forms.

The several members of the group show mental differences quite as striking as those exhibited by their external form, and more than perhaps might be expected from the similarity of their cerebral organization. The patience of the ass, the high spirit of the horse, the obstinacy of the mule, have long been proverbial. It is very remarkable that, out of so many species, two only should have shown any aptitude for domestication, and that these two should have been from time immemorial the universal and most useful companions and servants of man, while all the others remain in their native freedom to this day. It is, however, still a question whether this really arises from a different mental constitution causing a natural capacity for entering into relations with man, or whether it may not be owing to their having been brought gradually into this condition by long continued and persevering efforts when the need of their services was keenly felt. It is quite possible that one reason why most of the attempts to add new species to the list of our domestic animals in modern times have ended in failure is that it does not answer to do so in cases in which existing species supply all the principal purposes to which the new ones might be put. It can hardly be expected that zebras and quaggas fresh from their native mountains and plains can be brought into competition as beasts of burden and draught with horses and asses, whose naturally useful qualities have been augmented by the training of thousands of generations of progenitors.

Not infrequently instances occur of domestic horses being produced with a small additional toe with complete hoof, usually on the inside of the principal toe, and, though far more rarely, three or more toes may be present. These malformations are often cited as instances of reversion to the condition of some of the earlier forms of equine animals previously mentioned. Such explanations, however plausible they appear at first sight, are nevertheless very doubtful. All the feet of polydactyle horses which we have examined bear little resemblance to those of the extinct *Hipparion* or *Anchitherium*, but look rather as if due to that tendency to reduplication of parts which occurs so frequently as a teratological condition, especially among domestic

animals, and which, whatever its origin, certainly cannot in many instances, as the case of entire limbs super-added, or of six digits in man, be attributed to reversion.

Skeleton.—The skull as a whole is greatly elongated, chiefly in consequence of the immense size of the face as compared with the hinder or true cranial portion. The formation of the skull is best seen in accompanying illustration.



Side view of skull of horse, with the bone removed so as to expose the whole of the teeth. *PMx*, premaxilla; *Mx*, maxilla; *Na*, nasal bone; *Ma*, malar bone; *L*, lachrymal bone; *Fr*, frontal bone; *Sq*, squamosal bone; *Pa*, parietal bone; *oc*, occipital condyle; *pp*, paroccipital process; *i*¹, *i*², and *i*³, the three incisor teeth; *c*, the canine tooth; *pm*¹, the situation of the rudimentary first premolar, which has been lost in the lower, but is present in the upper jaw; *pm*², *pm*³, and *pm*⁴, the three fully-developed premolar teeth; *m*¹, *m*², and *m*³, the three true molar teeth.

The vertebral column consists of seven cervical, eighteen dorsal, six lumbar, five sacral, and fifteen to eighteen caudal vertebrae. There may be nineteen rib-bearing vertebrae, in which case five only will be reckoned as belonging to the lumbar series. The odontoid process of the atlas is wide, flat and hollowed above, as in the ruminants. The bodies of the cervical vertebrae are elongated, strongly keeled, and markedly opisthocœlous, or concave behind and convex in front. The neural laminae are very broad, the spines almost obsolete, except in the seventh, and the transverse processes not largely developed. In the trunk vertebrae the opisthocœlous character of the centrum gradually diminishes. The spinous processes of the anterior thoracic region are high and compressed. To these is attached the powerful elastic ligament, *ligamentum nuchæ*, or "paxwax," which, passing forward in the middle line of the neck above the neural arches of the cervical vertebrae, to which it is also connected, is attached to the occiput and supports the weight of the head. The transverse processes of the lumbar vertebrae are long, flattened, and project horizontally outward or slightly forward from the arch. The metapophyses are moderately developed, and there are no anapophyses. The caudal vertebrae, except those quite at the base, are slender and cylindrical without processes and without chevron bones beneath. The ribs are eighteen or nineteen in number on each side, flattened, and united to the sternum by short, stout, tolerably well ossified sternal ribs. The sternum consists of six pieces; the anterior or præsternum is extremely compressed, and projects forward like the prow of a boat. The segments which follow gradually widen, and the hinder part of the sternum is broad and flat.

As in all other ungulates, there are no clavicles. The scapula is long and slender; the supra-scapular border is rounded, and slowly and imperfectly ossified. The spine is very slightly developed; rather above the middle its edge is thickened and somewhat turned backward, but it gradually subsides at the lower extremity without forming any acromial process. The coracoid is a prominent rounded nodule. The humerus is stout and rather short. The ulna is quite rudimentary, being only represented by little more than the olecranon. The shaft gradually tapers below and is firmly ankylosed to the radius. The latter bone is of nearly equal width throughout. The three bones of the first row of the carpus (the scaphoid, lunar, and cuneiform) are subequal in size. The second row consists of a very broad and flat magnum, supporting the great third metacarpal, having to its radial side the trapezoid, and to its ulnar side the unciform, which are both small, and articulate distally with the rudimentary second and fourth metacarpals. The pisiform is large and prominent, flattened, and curved; it articulates partly with the cuneiform and partly with the lower end of the radius. The large metacarpal is called in veterinary anatomy "cannon bone;" the small lateral metacarpals, which gradually taper toward their lower extremities and lie in close contact with the large one, are called "splint bones." The single digit consists of a moderate-sized proximal (*os suffraginis*, or large pastern), a very short middle (*os coronæ*, or small pastern), and a wide, semi-lunar, ungual phalanx (*os pedis*, or coffin bone.) There is a pair of large nodular sesamoids behind the metacarpo-phalangeal articulation, and a single large transversely-extended sesamoid behind the joint between the second and third phalanx, called the "navicular bone."

The carpal joint, corresponding to the wrist of man, is commonly called the "knee" of the horse, the joint between the metacarpal and the first phalanx the "fetlock," that between the first and second phalanges the "pastern," and that between the second and third phalanges the "coffin joint."

In the hinder limb the femur is marked, as in all other known perissodactyles, by the presence of a "third trochanter," a flattened process, curving forward, arising from the outer side of the bone, about one-third of the distance from the upper end. The fibula is reduced to a mere styliform rudiment of the upper end. The lower part is absent or completely fused with the tibia. The os calcis has a long and compressed calcaneal process. The astragalus has a large flat articular surface in front for the navicular, and a very small one for the cuboid. The navicular and the external cuneiform bones are very broad and flat. The cuboid is small, and the internal and middle cuneiform bones are small and united together. The metapodals and phalanges resemble very closely those of the fore limb, but the principal metatarsal is more laterally compressed at its upper end than is the corresponding metacarpal. The joint between the femur and tibia, corresponding to the knee of man, is called the "stifle joint;" that between the tibia and tarsus, corresponding to the ankle of man, is called the "hock." The bones and joints of the foot have the same names as in the fore limb. The horse is eminently "digitigrade," standing on the extremity of the single digit of each foot, which is kept habitually in a position approaching to vertical.

The muscles of the limbs are modified from those of the ordinary mammalian type in accordance with the reduced condition of the bones and the simple requirements of flexion and extension of the joints, no such actions as pronation and supination, or opposition of digits, being possible or needed. The muscles therefore

which perform these functions in other quadrupeds are absent or rudimentary.

Below the carpal and tarsal joints, the fore and hind limbs correspond almost exactly in structure as well as function. On the anterior or extensor surface of the limb a powerful tendon, that of the anterior extensor of the phalanges (corresponding to the *extensor communis*



Section of foot of horse. 1, metacarpal bone; 2, first phalanx (*os suffraginis*); 3, second phalanx (*os coronæ*); 4, third or ungual phalanx (*os pedis*, or coffin bone); 5, one of the upper sesamoid bones; 6, lower sesamoid or navicular bone; 7, tendon of anterior extensor of the phalanges; 8, tendon of superficial flexor (*fl. perforatus*); 9, tendon of deep flexor (*fl. perforans*); 10, suspensory ligament of fetlock; 11, inferior or short sesamoid ligament; 12, derma or skin of the foot, covered with hair, and continued into 13, the coronary cushion, 14, the podophyllous or laminar membrane, and 15, the keratogenous membrane of the sole; 16, plantar cushion; 17, hoof; 18, fatty cushion of fetlock. *digitorum* of the arm and *extensor longus digitorum* of the foot of man) passes down over the metacarpal bone and phalanges, to be inserted mainly into the upper edge of the anterior surface of the last phalanx or pedal bone. There is also a much smaller second extensor on the outer side of this in each limb, the lateral extensor of the phalanges. In the foreleg the tendon of this muscle (which corresponds with the *extensor minimi digiti* of man) receives a slip from that of the principal extensor, and is inserted into the first phalanx. In the hind leg (where it is the homologue apparently of the *peroneus brevis* of man) the tendon becomes blended with that of the large extensor.

A very strong ligamentous band behind the metapodium, arising from near the upper extremity of its posterior surface, divides into two at its lower end, and each division, being first connected with one of the paired upper sesamoid bones, passes by the side of the first phalanx to join the extensor tendon of the phalanges. This is called in veterinary anatomy the "suspensory ligament of the sesamoids," or of the "fetlock;" but its attachments and relations, as well as the occasional presence of muscular fibers in its substance, show that it is the homologue of the interosseous muscles of other mammals, curiously modified both in structure and function, to suit the requirements of the horse's foot. Behind or superficial to this are placed the two strong tendons of the flexor muscles, the most superficial, or *flexor perforatus*, dividing to allow the other to pass through, and then inserted into the middle phalanx. The *flexor perforans* is as usual inserted into the terminal phalanx. In the foreleg these muscles correspond with those similarly named in man. In the hind leg the perforated tendon is a continuation of that of the plantaris, passing pulley-wise over the tuberosity of the os calcis. The perforating tendon is derived from the

muscle corresponding with the long flexor of man, and the smaller tendon of the oblique flexor (*tibialis porticus* of man) is united with it.

The hoof of the horse corresponds to the nail or claw of other mammals, but it is so constructed as to form a complete and very solid case to the expanded termination of the toe, giving a firm basis of support formed of a non-sensitive substance, which is continually renewed by the addition of material from within, as its surface wears away by friction against the ground. The terminal phalanx of the toe is greatly enlarged and modified in form to support this hoof, and the size of the internal framework of the foot is further increased by a pair of lateral fibro-cartilaginous masses attached on each side to the hinder edges of the bone, and by a fibro-cellular and adipose plantar cushion in the median part. These structures are all inclosed in the keratogenous membrane or "subcorneous integument," a continuation of the ordinary derma of the limb, but extremely vascular and having its superficial extent greatly increased by being developed into papillæ or laminæ. From this the horny material which constitutes the hoof is exuded. A thickened ring encircling the upper part, called coronary cushion, and the sole are covered with numerous thickly set papillæ or villi, and take the greatest share in the formation of the hoof; the intermediate part constituting the front and side of the foot, corresponding with the wall of the hoof, is covered with parallel, fine longitudinal laminæ, which fit into corresponding depressions in the inner side of the horny hoof.

The horny hoof is divided into a wall or crust consisting of the front and sides, the flattened or concave sole, and the frog, a triangular median prominence, notched posteriorly, with the apex turned forward, situated in the hinder part of the sole. It is formed of pavement epithelial cells, which are mainly grouped in a concentric manner around the vascular papillæ of the keratogenous membrane, so that a section near the base of the hoof, cut transversely to the long axis of these papillæ, shows a number of small circular or oval orifices, with cells arranged concentrically round them. The nearer the surface of the hoof, or further removed from the seat of growth, the more indistinct the structure becomes.

Small round or oval plates of horny epithelium called "chestnuts," growing like the hoof from enlarged papillæ of the skin, are found on the inner face of the fore arm, above the carpal joint in all species of *Equidæ*, and in the horse (*E. caballus*) similar formations occur near the upper extremity of the inner face of the metatarsus. Their use is unknown.

Dentition.—The dentition of the horse, when all the teeth are in place, is, as seen from illustration of skull, expressed by the formula $i. \frac{3}{3}, c. \frac{1}{1}, p. \frac{4}{4}, m. \frac{3}{3} = 44$. The incisors of each jaw are placed in close contact, forming a semicircle. The crowns are broad, somewhat awl-shaped, and of nearly equal size. They have all the great peculiarity, not found in the teeth of any other mammal, and only in the *Equidæ* of comparatively recent geological periods, of an involution of the external surface of the tooth, by which what should properly be the apex is carried deeply into the interior of the crown, forming a fossa or pit, the bottom of which becomes partially filled up with crusta petrosa or cementum. As the tooth wears, the surface, besides the external enamel layer as in an ordinary simple tooth, shows in addition a second inner ring of the same hard substance surrounding the pit, which of course adds greatly to the efficiency of the tooth as an organ for biting tough, fibrous substances. This pit, generally filled in the living animal with particles of food, is conspicuous from its dark color, and constitutes the

"mark" by which the age of the horse is judged, as in consequence of its only extending to a certain depth in the crown it becomes obliterated as the crown wears away, and then the tooth assumes the character of that of an ordinary incisor, consisting only of a core of dentine, surrounded by the external enamel layer. It is not quite so deep in the lower as in the upper teeth. The canines are either quite rudimentary or entirely absent in the female. In the male they are compressed, pointed, and smaller than the incisors, from which they are separated by a slight interval. The teeth of the molar series are all in contact with each other, but separated from the canines by a considerable toothless space. The anterior premolars are quite rudimentary, sometimes not developed at all, and generally fall by the time the animal attains maturity, so that there are but six functional grinding teeth—three that have predecessors in the milk dentition, and hence are considered as premolars, and three true molars, but otherwise, except the first and the last of the series, not distinguishable in form or structure. These teeth in both upper and lower jaws are extremely long-crowned or hypsidont, successive portions being pushed out as the surface wears away, a process which continues until the animal becomes advanced in age. The enameled surface is infolded in a complex manner (a modification of that found in other perissodactyles), the folds extending quite to the base of the crown, and the interstices being filled and the surface covered with a considerable mass of cement, which binds together and strengthens the whole tooth. As the teeth wear, the folded enamel, being harder than the other constituents, the dentine and cements, forms projecting ridges on the surface arranged in a definite pattern, which gives it great efficiency as a grinding instrument. The free surfaces of the upper teeth are quadrate, except the first and last, which are nearly triangular. The lower teeth are much narrower than the upper.

The milk dentition consists of $i. \frac{3}{3}, c. \frac{0}{0}, m. \frac{3}{3} = 24$ —the canines and first or rudimentary premolars having apparently no predecessors. In form and structure they much resemble the permanent teeth, having the same characteristic enamel foldings. Their eruption commences a few days after birth, and is complete before the end of the first year, the upper teeth usually appearing somewhat earlier than those of the lower jaw. The first teeth which appear are the first and second milk molars (about five days), then the central incisor (from seven to ten days); this is followed by the second incisor (at one month), then the third molar, and finally the third incisor. Of the permanent teeth the first true molar appears a little after the end of the first year, followed by the second molar before the end of second year. At about two and a half years the first premolar replaces its predecessor. Between two and a half and three years the first incisor appears. At three years the second and third premolars and the third true molar have appeared, at from three and a half to four years the second incisor, at four to four and a half years the canine, and, finally, at five years, the third incisor, completing the permanent dentition. Up to this period the age of the horse is clearly shown by the condition of dentition, and for some time longer indications can be obtained from the wear of the incisor teeth, though this depends to a certain extent upon the hardness of the food or other accidental circumstances. As a general rule, the depression caused by the infolding of the surface of the incisor (the "mark") is obliterated in the first or central incisor at six years, in the second at seven years, and in the third at eight years. In the upper teeth, as the depressions are deeper, this obliteration does not take place until about two years later.

After this period no certain indications can be obtained of the age of the horse from the teeth.

Digestive Organs.—The lips are flexible and prehensile. The membrane that lines them and the cheeks is quite smooth. The palate is long and narrow; its mucous surface has seventeen pairs of not very sharply defined oblique ridges, extending as far back as the last molar tooth, beyond which the velum palati extends for about three inches, having a soft corrugated surface, and ending posteriorly in an arched border without uvula. This embraces the base of the epiglottis, and, except while swallowing food, shuts off all communication between the cavity of the mouth and the pharynx, respiration being, under ordinary circumstances, exclusively through the nostrils. Between the mucous membrane and the bone of the hard palate is a dense vascular and nervous plexus. The membrane lining the fauces is soft and corrugated. An elongated raised glandular mass, three inches long and one inch from above downward, extending backward from the root of the tongue along the side of the fauces, with openings on the surface leading into crypts with glandular walls, represents the tonsil. The tongue, corresponding to the general form of the mouth, is long and narrow. It consists of a compressed intermolar portion with a flat upper surface, broad behind and becoming narrower in front, and of a depressed anterior part rather shorter than the former, and which is narrow behind and widens toward the evenly rounded apex. The dorsal surface is generally very soft and smooth. There are two large circumvallate papillæ near the base, rather irregular in form, about a quarter of an inch in diameter and half an inch apart. The conical papillæ are very small and close set, though longer and more filamentous on the intermolar portion. There are no fungiform papillæ on the dorsum, but a few not very conspicuous ones scattered along the sides of the organ.

Of the salivary glands the parotid is by far the largest, and elongated in the vertical direction, and narrower in the middle than at either upper or lower extremity. Its upper extremity embraces the lower surface of the cartilaginous ear-conch; its lower end reaches the level of the inferior margin of the mandible, along the posterior margin of which it is placed. Its duct leaves the inferior anterior angle, at first descends a little, and runs forward under cover of the rounded inferior border of the mandibular ramus, then curves up along the anterior margin of the masseter muscle, becoming superficial, pierces the buccinator, and enters the mouth by a simple aperture opposite the middle of the crown of the third premolar tooth. It is not quite so thick as a goosequill when distended, and nearly a foot in length.

The submaxillary gland is of very similar texture to the last, but much smaller; it is placed deeper, and lies with its main axis horizontal. It is elongated and slender, and flattened from within outward. Its posterior end rests against the anterior surface of the transverse process of the atlas, from which it extends forward and downward, slightly curved, to beneath the ramus of the jaw. The duct which runs along its upper and internal border passes forward in the usual course, lying in the inner side of the sublingual gland, to open on the outer surface of a distinct papillæ, situated on the floor of the mouth, half an inch from the middle line, and midway between the lower incisor teeth and the attachment of the frænum linguæ. The sublingual is represented by a mass of glands lying just beneath the mucous membrane of the floor of the mouth on the side of the tongue, causing a distinct ridge, extending from the frænum backward, the numerous ducts opening separately along the summit of the ridge. The buccal glands are arranged in two rows parallel with the molar

teeth. The upper ones are the largest, and are continuous anteriorly with the labial glands, the ducts of which open on the mucous membrane of the upper lip.

The stomach of the horse is simple in its external form, with a largely developed right *cul de sac*, and is a good deal curved on itself, so that the cardiac and pyloric orifices are brought near together. The antrum pyloricum is small and not very distinctly marked off. The interior is divided by the character of the lining membrane into two very distinct portions, right and left. Over the latter the dense white, smooth epithelial lining of the œsophagus is continued, terminating abruptly by a raised crenellated border. Over the right part (rather the larger portion) the mucous membrane has a grayish-red color and a velvety appearance, and contains very numerous peptic glands, which are wanting in the cardiac portion. The œsophageal orifice is very small, and is guarded by a strong crescentic or rather horseshoe-like band of muscular fibers, which is supposed to be the cause of the difficulty of vomiting in the horse. The small intestine is of great length (eighty to ninety feet), its mucous membrane being covered with numerous fine villi. The cæcum is of conical form, about two feet long and nearly a foot in diameter; its walls are sacculated, especially near the base, having four longitudinal muscular bands; and its capacity is about twice that of the stomach. It lies with its base near the lower part of the abdomen, and its apex directed toward the thorax. The colon is about one-third the length of the small intestine, and very capacious in the greater part of its course. As usual it may be divided into an ascending, transverse, and descending portion; but the middle or transverse portion is folded into a great loop, which descends as low as the pubis; so that the colon forms altogether four folds, generally parallel to the long axis of the body. The descending colon is much narrower than the rest, and not sacculated, and, being considerably longer than the distance it has to traverse, is thrown into numerous folds.

The liver is tolerably symmetrical in its general arrangement, being divided nearly equal into segments by a well-marked umbilical fissure. Each segment is again divided by lateral fissures, which do not extend quite to the posterior border of the organ; of the central lobes thus cut off, the right is rather the larger, and has two fissures in its free border subdividing it into lobules. The extent of these varies, however, in different individuals. The two lateral lobes are subtriangular in form. The Spiegelian lobe is represented by a flat surface between the portal fissure and the posterior border, not distinctly marked off from the left lateral by a fissure of the ductus venosus, as this vessel is buried deep in the hepatic substance, but the caudate lobe is distinct and tongue-shaped, its free apex reaching nearly to the border of the right lateral lobe. In most works on the anatomy of the horse this has been confounded with the Spiegelian lobe of man. There is no gall-bladder, and the biliary duct enters the duodenum about six inches from the pylorus. The pancreas has two lobes or branches, a long one passing to the left and reaching the spleen, and a shorter right lobe. The principal duct enters the duodenum with the bile-duct, and there is often a second small duct which opens separately near to this.

Circulatory and Respiratory Organs.—The heart has the form of a rather elongated and pointed cone. There is one anterior vena cava, formed by the union of the two jugular and two axillary veins. The aorta gives off a large branch (the anterior aorta) very near its origin, from which arise—first, the left axillary, and afterward the right axillary and the two carotid arteries.

Under ordinary circumstances the horse breathes entirely by the nasal passages, the communication between the larynx and the mouth being closed by the velum palati. The nostrils are placed laterally, near the termination of the muzzle, and are large and very dilatable, being bordered by cartilages upon which several muscles act. Immediately within the opening of the nostril, the respiratory canal sends off on its upper and outer side a diverticulum or blind pouch (called "false nostril") of a conical form, and curved, two to three inches in depth, lying in the notch formed between the nasal and premaxillary bones. It is lined by mucous membrane continuous with that of the nasal passage, and its use is not apparent. It is longer in the ass than in the horse. Here may be mentioned the guttural pouches, large air sacs, diverticula from the Eustachian tubes, and lying behind the upper part of the pharynx, the function of which is also not clearly understood. The larynx has the lateral sacculi well developed, though entirely concealed within the alæ of the thyroid cartilage. The trachea divides into two bronchi, one for each lung.

Nervous System.—The brain differs little, except in details of arrangement of convolutions, from that of other ungulates. The cerebral hemispheres are rather elongated and subcylindrical, the olfactory lobes are large, and project freely in front of the hemispheres, and the greater part of the cerebellum is uncovered. The eye is provided with a nictitating membrane or third eyelid, at the base of which the ducts of the Harderian gland open.

Reproductive System.—The testes are situated in a distinct sessile or slightly pedunculated scrotum, into which they descend from the sixth to the tenth month after birth. The accessory generative glands are the two vesiculæ seminales, with the median third vesicle, or *uterus masculinus*, lying between them, the single bilobed prostate, and a pair of globular Cowper's glands. The penis is very large, cylindrical, with a truncated, expanded, flattened termination. When in a state of repose it is retracted, by a muscle arising from the sacrum, within the prepuce; a cutaneous fold attached below the symphysis pubis.

The uterus is bicornuate. The vagina is often partially divided by a membranous septum or hymen. The mammae are two, inguinally placed. The surface of the chorion is covered evenly with minute villi, constituting a diffuse non-deciduate placenta. The period of gestation is eleven months.

History.—The first mention of the British horse occurs in the well-known passages in Cæsar, in which he mentions the native "essedarii" and the skill with which they handled their war chariots. We are left quite in the dark as to the character of the animal thus employed; but there would appear to be much probability in the surmise of Youatt, who conjectures the horse to have been, "then as ever, the creature of the country in which he lived. With short fare, and exposed to the rigor of the seasons, he was probably the little hardy thing we yet see him; but in the marshes of the Nen and the Witham, and on the borders of the Tees and the Clyde, there would be as much proportionate development of frame and strength as we find at the present day."

The period of the Norman Conquest marks an important stage in the history of the British horse. William the Conqueror's own horse was of the Spanish breed, and others of the same kind were introduced by the barons on their estates. But the Norman horses included many varieties, and there is no doubt that to the Conquest the inhabitants of Britain were indebted for a decided improvement in the native horse, as well as for

the introduction of several varieties previously unknown.

In 1121 two Eastern horses are said to have been imported—one of them remaining in England, and the other being sent as a present by King Alexander I. to the church of St. Andrews, in Scotland. It has been alleged that these horses were Barbs from Morocco, but a still more likely theory is that they existed only in name, and never reached either England or Scotland. The crusades were probably the means of introducing fresh strains of blood into England, and of giving opportunity for fresh crossings. The Spanish jennet was brought over about 1182. King John gave great encouragement to horse-breeding; one of his earliest efforts was to import one hundred Flemish stallions, and, having thus paved the way for improving the breed of agricultural horses, he set about acquiring a valuable stud for his own use.

Charles II. warmly espoused the introduction of Eastern blood into England. He sent his master of the horse abroad to purchase a number of foreign horses and mares for breeding, and the mares brought over by him (as also many of their produce) were called "royal mares;" they form a conspicuous feature in the annals of breeding. The *Stud-Book* shows of what breed the royal mares really were; one of them, the dam of Dodsworth (who, though foaled in England, was a natural Barb), was a Barb mare; she was sold by the stud-master, after Charles II.'s death, for forty guineas, at twenty years old, when in foal by the Helmsley Turk.

The reign of William III. is noteworthy as the era in which, among other importations, there appeared the first of three Eastern horses to which the modern thoroughbred race-horse traces back as the founders of his lineage. This was the Byerly Turk, of whom nothing more is known than that—to use the words of the first volume of the *Stud-Book*—he was Captain Byerly's charger in Ireland in King William's wars. The second of the three horses above alluded to was the Darley Arabian, who was a genuine Arab, and was imported from Aleppo by a brother of Mr. Darley of Aldby Park, Yorkshire, about the end of the reign of William III. or the beginning of that of Anne. The third horse of the famous trio was the Godolphin Arabian or Barb, brought to England about five and twenty years after the Darley Arabian. All the horses now on the British turf or at the stud trace their ancestry in the direct male line to one or other of these three—the Byerly Turk, the Darley Arabian, and the Godolphin Arabian or Barb. In the female line their pedigrees can be traced to other sources, but for all practical purposes it suffices to regard one or other of these three animals as the *ultima Thule* of racing pedigree. Of course there is a large interfusion of the blood of each of the trio through the dams of horses of the present day; indeed, it is impossible to find an English race-horse which does not combine the blood of all three.

The last epoch of the British horse, viz., that of the thoroughbred racer, may be taken to date from the beginning of the eighteenth century. By thoroughbred is meant a horse or mare whose pedigree is registered in the *Stud-Book* kept by Messrs. Weatherby, the official agents of the Jockey Club—originally termed the keepers of the match-book—as well as the publishers of the *Racing Calendar*.

The shape of a race-horse is of considerable importance, although it is said with some degree of truth that they win in all shapes. In height it will be found that the most successful racers average from fifteen to sixteen and one-half hands, the former being considered somewhat small, while the latter is unquestionably very

large; the mean may be taken as between fifteen and one-half and sixteen hands (the hand = four inches). The head should be light and lean, and well set on; the ears small and pricked, but not too short; the eyes full; the forehead broad and flat; the nostrils large and dilating; the muzzle fine; the neck moderate in length, wide, muscular, and yet light; the throat clean; the windpipe spacious and loosely attached to the neck; the crest thin, not coarse and arched; the withers may be moderately high and thin; the chest well developed, but not too wide or deep; the shoulders should lie well on the chest, and be oblique and well covered with muscle, so as to reduce concussion in galloping; the upper and lower arms should be long and muscular; the knees broad and strong; legs short, flat, and broad; fetlock joints large; pasterns strong and of moderate length; the feet should be moderately large, with the heels open and frogs sound—with no signs of contraction. The body or barrel should be moderately deep, long, and straight, the length being really in the shoulders and in quarters, the back should be strong and muscular, with the shoulders and loins running well in at each end; the loins themselves should have great breadth and substance, this being a vital necessity for weight-carrying and propelling power uphill. The hips should be long and wide, with the stifle and thigh strong, long, and proportionately developed, and the hind quarters well let down. The hock should have plenty of bone, and be strongly affixed to the leg, and show no signs of curb; the bones below the hock should be flat, and free from adhesions; the ligaments and tensions well developed, and standing out from the bone; the joints well formed and wide, yet without undue enlargement; the pasterns and feet similar to those of the forehand. The tail should be high set on, the croup continuing in a straight line to the tail, and not falling away and drooping to a low set tail. Fine action is the best criterion of everything fitting properly, and all a horse's points ought to harmonize or be in proportion to one another, no one point being more prominent than another, such as good shoulders, fine loins, or excellent quarters. If the observer is struck with the remarkable prominence of any one feature, it is probable that the remaining parts are deficient. A well-made horse wants dissecting in detail, and then if a good judge can discover no fault with any part, but finds each of good proportion, and the whole to harmonize without defect, deformity, or deficiency, he has before him a well-shaped horse; and of two equally well-made and equitably well-proportioned horses the best bred one will be the best. As regards hue, the favorite color of the ancients, according to Zenophon, was bay, and for a long time it was the fashionable color in England; but for some time chestnut thoroughbreds have been the most conspicuous figure on English race-courses, so far as the more important events are concerned. Eclipse was a chestnut; Castrel, Selim, and Rubens were chestnuts; so also were Glencoe and Pantaloon, of whom the latter had black spots on his hind quarters like Eclipse, and more recently Stockwell and Doncaster. Birdcatcher was a chestnut, so also were Stockwell and his brother Ratanplan, Manganese, Mandragora, Thormanby, Kettle-drum, St. Albans, Blair Athol, Regalia, Formosa, Hermit, Marie Stuart, Doncaster, George Frederick, Apology, Craig Millar, Prince Charlie, Rayon d'Or, and Bend Or. The dark browns or black browns, such as the Sweetmeat tribe, are not so common as the bays, and black or gray horses are almost as unusual as roans. The skin and hair of the thoroughbred are finer, and the veins which underlie the skin are larger and more prominent than in other horses. The mane and tail should be silky and devoid of curl, which is a sign of impurity.

Whether the race-horse of to-day is as good as the stock to which he traces back has often been disputed, chiefly no doubt because he is brought to more early maturity, commencing to win races at two years instead of at five years of age, as in the days of Childers and Eclipse; but the highest authorities, and none more emphatically than the late Admiral Rous, aver that he can not only stay quite as long as his ancestors, but also go a good deal faster. In size and shape the modern race-horse is unquestionably superior, being on an average fully a hand higher than the Eastern horses from which he is descended; and in elegance of shape and beauty of outline he has certainly never been surpassed. That experiments, founded on the study of his nature and properties, which have from time to time been made to improve the breed, and bring the different varieties to the perfection in which we now find them, have succeeded, is best confirmed by the high estimation in which the horses of Great Britain are held in all parts of the civilized world; and it is not too much to assert that, although the cold, humid, and variable nature of their climate is by no means favorable to the production of these animals in their very best form, Englishmen have by great care, and by sedulous attention to breeding, high feeding, and good grooming, with consequent development of muscle, brought them to the highest state of perfection of which their nature is capable.

The Hunter.—A good specimen of an English hunter may be described as a horse for universal use. He may be a coach-horse, for in many of the animals running in the coaches called into existence during the summer months, by the coaching revival may be recognized a hunter of known character; he may be a good roadster, for, so far as conformation is concerned, there is nothing in a hunter to unfit him from being a first-class hack; nor is hunting incompatible with military duties, for, by the regulations of the service, officers are permitted to hunt their second chargers. For harness work he is perfectly adapted, provided only the vehicle to be drawn is in proportion to his size; while most people will recall instances of hunters having for some reason or other to be so far humbled as to have to take a turn at the plow or harrow, or, in their older days, even in a chaff-cutter. A hunter may be either thoroughbred or halfbred. It is often said that thoroughbreds do not make pleasant hunters, but the complaint, if there is any ground for it at all, is really against the result of the treatment to which nineteen out of the twenty thoroughbreds have to submit, and not against pure blood itself. A large proportion of the thoroughbred stock come to the starting post at two years old; and this means that they have been in the trainer's hands since they were yearlings at least. Now a training stable is just the place for colts to pick up sundry undesirable tricks, which may at some future time cause the unprofessional rider a little trouble; they get to lean on the hand, often turn out fidgety and fractious, and are not infrequently inveterate pullers. When fit to go, the young one will have been tried, and if he fails to gallop half a mile at best pace he is probably turned out of training, although perhaps it was not till the last dozen yards were reached that there was any sign of failing power. Now, although the colt may be unable to stand the test applied to him by the trainer, there is no reason at all why he should not be able to go all day at hunting pace, because the powers of speed are not taxed to the same degree. The young thoroughbred is then perhaps educated for hunting; and hence it is that nearly all hunters—thoroughbred ones, that is to say—begin life in a training stable.

In breeding a hunter the choice of a dam is a matter

of moment; and it is difficult to see why anything should be thought good enough for a hunter, even by the inexperienced. The first requisite for a brood-mare is that she should be free from all constitutional infirmities, such as roaring, bad sight, etc.; and the breeder should be on his guard when breeding from mares whose legs have given way. True, it may be the result of an accident, but care should be taken to ascertain that it arose from that cause, and that a predisposition to inflammation had nothing to do with it. For the same reason persons should be chary of breeding from mares that have splints, spavins, etc., and should certainly reject one whose dam or sire had them as well. Mares that have done much hard work are not the best dams that can be selected, as they are apt to slip their foals, or to throw undersized ones. The selection of a stallion is the more important the more defects there are in the mare. Should she be the least delicate, the stallion should be remarkable for a hardy constitution, for considering that a hunter has to be out of his stable for as much as twelve hours sometimes, and rarely less than seven or eight, and has to carry a heavy weight and gallop and jump, it is plain that a horse with no stamina would be nearly worthless as a hunter, no matter what other good qualities he might possess. So, too, as to shape; should the mare be too long on the leg or in the back, or too low in front, the stallion should be singularly free from the defect in question.

While the mare is in foal she should be kept on the best food, for the nourishment given to her is given indirectly to the foal. The keep of the foal in its early days is not less important than the choice of dam and sire. Thoroughbred colts eat corn from the time they are a month or five weeks old; and the same generous diet should be allowed to halfbred horses, as it is only by this, accompanied of course by proper exercise, that the frames of young horses expand to their full extent, or that a foundation is laid for a good constitution.

The breaking and training of hunters is all-important, because, in spite of the care that may have been expended upon the choice of sire and dam and the keep of the colt, many young ones are ruined beyond all hope of recovery during this process. The colt should be handled from the day of its birth, so that it may grow thoroughly accustomed to man, without ever having experienced the feeling of fear. The person selected to attend on mares and foals, as well as he that undertakes the training part, should be naturally fond of animals; he should be cool and of an almost imperturbable temper, or he will be unfitted to deal with the waywardness of some of his pupils, which during their early career may at times expose him to personal danger, especially if they be well bred; he should therefore be well endowed with courage and firmness, for an irresolute man is sure to spoil every horse he has to do with.

The Hack.—Under the term "hack" may be ranked cover hack, park hack, cob, pony, and, in short, saddle-horses of all kinds save hunters and racers.

The park hack, as its name implies, is for use in fashion-frequented places, and must therefore be worth looking at. Fashion has prescribed that the genuine thing shall be about 14.3, with a small and well set-on head, good sloping shoulders, and well-formed hind legs; he must also be very well bred. So much for his points. A wonderfully good temper is absolutely essential. Street vehicles give but little place to the equestrian, and a series of hurried retreats out of harm's way might ruffle a horse of uncertain temper and not hard worked into the bargain. He should be bitted to a nicety, and should have been thoroughly well trained. Especial care should be exercised in the selection of the

lady's horse; and the perfection which is so often theoretical in the case of a gentleman's hack should approach a reality when a horse is intended to carry a lady. With regard to the size, it had better not be under 15.1 at the least, and should have very good shoulders and by no means a short neck, or else the rider will experience that uncomfortable sensation of having nothing in front of the saddle.

The cob is a nondescript animal, but withal a very valuable one when good. An underbred thickset animal, termed a "stocky" horse, is not the fashionable cob, which should have a good deal of breeding and the strength of a dray-horse. Although a cob should not exceed 14.1, he should be very strong, being generally ridden by elderly heavy persons. To be worth a large sum he must unite to a symmetrical shape an even temper, perfect manners, and easiness in his paces.

A Galloway, although strictly speaking a distinct breed, is commonly understood to be a horse of not over fourteen hands.

A pony must be less than fifty-two inches (thirteen hands) from the ground to the top of the withers; else he is a Galloway. Ponies, as a rule, will do far more work than a full-sized horse; they improve wonderfully in a well-organized stable; they are, it is said, never lame in the feet, and seldom become roarers; but, as a set off against these good points, they are often very tricky, and sometimes troublesome in the stable.

The breeding of hacks, like breeding for any particular stamp of horse, is all chance work, especially in the case of halfbreeds. A rather small thoroughbred horse and a hackney mare may produce a thing like a pony, or a bigger animal that is quite useless for saddle work. Even in breeding for hunters, two or perhaps three out of five colts will grow up more fitted for the shafts than for a bridle. Perhaps the generality of hacks are either thoroughbreds which have been turned out of training, or horses that have grown up too small for hunting purposes.

The Charger and Troop-Horse.—A charger, fit for the mounted arm of the service, is a difficult article to meet with, at least a perfect one is, because so many good qualities must be found combined. A hunter is capital raw material out of which to make a charger; but appearance, which is not a *sine qua non* in a hunter, is indispensable in a charger, which must also have high action, though the paces must be easy in consequence of much riding having to be done without stirrups. The best size for a charger or a trooper is about 15.2 or 15.3; moderate-sized horses can be made more handy than larger ones, and experience seems to show that they are more hardy and better doers than horses of greater stature.

The troop-horse must be as much like the charger as possible, but, as the trooper's price is limited, a difference, and that a very striking one, must always exist. The bulk of the troop-horses are bought when rising four years, having of course been passed by the veterinary surgeon; and, being nourished on the best food, these often develop into well-grown animals by the time they take their place in the ranks. Before that time comes, however, there is a good deal to be done in the way of training, for no matter how quiet the four-year-old may be to ride, or how well he may have been broken from a civilian's point of view, he is no more fitted for cavalry purposes, until he has passed through the rough rider's hands, than if he had never been handled at all.

As the cavalry soldier has to use his weapons with one hand, he has only one for the reins; and this renders it important first that the horse should be so broken that the rider can effect with his leg or heel what civilians do

with the second hand, and next that the horse should be well under the control of a single hand. As before remarked, the position of the head makes a great difference in the ease with which the horse can be governed, and as troopers have all to do the same things in the saddle, it follows that they should as far as possible all ride the same sort of horses; accordingly all troop-horses are trained to carry their heads as nearly as possible in one position, that being chosen in which the angle formed by the head and neck gives most power to the rider.

Harness-Horses.—Just as a hunter is metamorphosed into a hack by using a sharper bit and riding him on the road, so the mere fact of driving a horse in harness makes him a harness-horse, whether he really be hack, hunter or charger.

The Cart-Horse.—At the present time it is difficult to classify cart-horses, and to point to any distinct breeds. The true Cleveland horse is practically extinct, and the animal now called a Cleveland bay bears but a slight resemblance to his ancestors. The old Cleveland horses were noted for their strength; they are said to have carried a weight of 760 lb., or more than fifty-four stone, a distance of sixty miles in twenty-four hours. The old Suffolk Punch, originally descended from Norman stallions and Suffolk cart mares, is also extinct, the modern representative of that breed being the result of different crossings; he is found of two different kinds, light and heavy. The Clydesdale horse is well adapted for use in a hilly country. It derives its name from a district on the Clyde in Scotland, whither it was introduced by one of the dukes of Hamilton, who crossed the Lanark mares with imported Flemish stallions.

The native English cart-horse is a huge animal, usually of a black color, and stands about seventeen hands high and more. These horses are bred chiefly but not solely in Lincolnshire. At two years old they are generally sold by the breeder, who thus is enabled to secure a fair profit at an early period. They are at once put to gentle work by the first purchaser, and so earn something toward their keep. During this period they are well fed, and when they have attained their fourth year they are made up for the market, by being fed with oilcake, grains and other fattening food, besides oats.

The use of these very heavy horses is now chiefly confined to brewers' drays, to contractors' trollies for conveying blocks of stone, and for drawing carts containing building materials, and heavy iron work, such as boilers, parts of bridges, etc. From their great size they require a large amount of food; and, although occasionally useful for drawing heavyweights, they are being gradually displaced by a lighter and more active horse.

The foregoing refers to the horse as at present existing in England. We shall now deal extensively with the American horse as at present existing and developed in this country. There were no horses in this country when Columbus discovered America, although the discovery of fossil remains amply prove that they, during geological periods, existed here. How and why they became extinct must remain a matter of speculation. The first introduction of the animal was by the Spaniards not long after the discovery of the continent. They were mainly taken to South America and formed the origin of the vast herds of horses now ranging the pampas of that continent. The descendants of these Spanish horses are also found in North America, Mexico, California, and Texas having vast herds of *Mustangs*, which are regarded as the progeny of the imported animals. The American horse, at the present day, is the descendant, in various degrees, of an admixture from the English thoroughbred racer. Early in

colonial times the gentlemen of the colonies began the importation of finely-bred horses, Virginia and Maryland being preëminent in this respect among their sister provinces. In 1730 Bully Rock, a descendant of Darley Arabian in the first generation, was brought over, and in 1740 Bonny Lass, a mare, descended from the same horse in the next degree, followed. After this time the importation of blooded stock became common, and it is said that more than 300 names are on the list of fine animals brought over prior and immediately subsequent to the Revolution. These were interbred with the preëxisting American stock, to the great improvement of the latter. From such a source the existing American racer sprung.

Prominent, and the most important indeed, among these importations was the thoroughbred stallion Messenger. He was brought to this country in 1788—being then eight years old. He stood for a long period in New York and Pennsylvania, and some of our best horses trace back to him. Among his distinguished descendants may be named Hambletonian, Potomac, Mambrino, Engineer, Bay Figure, Tippecanoe, and the great horse Eclipse. Another distinguished import was the Arabian Ranger, who is credited with the origin of a number of fine animals.

Among other breeds of horses, less for the race-track, and yet noted for beauty and excellence, may be mentioned the Morgans, the progenitor of which strain was a Vermont horse of unknown (or at least doubtful) ancestry. The Morgans are excellent roadsters, possessing much to recommend them, but having few marks of the thoroughbred.

The Narragansett pacers, now extinct, were also in their day a noted strain. They were bred in New England from a Spanish horse, imported by Governor Robinson. Their speed and endurance, and easy natural gait (a pace) made them great favorites, and large numbers of them were exported to Cuba, but the strain has been lost to sight, and no genuine specimen of the breed is now known to exist.

Of late years the breeding of draught-horses has received great attention in America—many large stock-farmers paying almost exclusive attention to their production. For this purpose they have spared neither pains nor expense, and on some of the breeding farms may be seen the finest specimens of Norman-Percheron, Clydesdale, and other heavy draught-stallions. Illinois stands in an honorable place on the list of States breeding draught-horses, and the result of the efforts of the breeders to attain excellence in the animals they produce may be seen every day on the streets of our larger American cities, than which no other localities of the world can exhibit finer, better-appearing draught animals. The Conestoga is a peculiarly American strain of draught-horse of unknown origin, so-called from the fact that it was produced in the Conestoga valley, Penn. They are very large, but do not incline to much flesh, and are quick in action, when their large size is taken into consideration.

But the crowning glory of American horse breeding is the trotting-horse. The development of this horse is interesting in the extreme. In the olden days of American races, the only gait known to the turf was running. As before shown, our runners came from England or were descendants of English horses. Races were a passion with the southern gentry, and Virginia and Kentucky were famous all over the world for their productions in the line of running-horses. Almost every hamlet in those two states had its race-track, and in many instances the gentlemen farmers kept their private tracks on which they speeded their horses or ran against their neighbors. There was a regular racing circuit

which included all these points, great and small, and the owners of the various horses traveled the circuit, being sure always of finding a contestant for the honors of the turf everywhere, no matter how small the town or village in point of population. For many years this state of affairs subsisted, the trotting-horse as yet being an unknown factor in racing matters. The older patrons of the turf did not readily or kindly take to the innovation of the trotter, for there yet "lag superfluous on the stage" old-fashioned horsemen who are persistently blind to the merits of the trotter, and declare that none other than a running-horse is a legitimate race-animal. But in spite of such opposition, the running-horse was destined for a time to be completely eclipsed by an animal of unknown or doubtful extraction, yet one whose present degree of perfection is one of the greatest triumphs of patience and judicious selection. As stated before, the trotters have no particular lineage; they were not, so to speak, "born to the purple," but only came to the front by sheer force of merit. One of the best of our older trotters (Dutchman) was a common cart-horse; and in but very few instances could any of them trace back to a thoroughbred origin. Some attempts have been made to establish the claim that the trotter is a distinct species or strain of horse, but this ground is clearly untenable if one will only consider the history of his origin. He, as at present existing, is but the result of the careful selection and mating of animals having a disposition to trot naturally, and then judiciously admixing later on the thoroughbred blood, with that of the progeny thus got. No breed of horses has ever made such rapid growth in speed as well as in public favor. At first 2:50 was thought good—very good—time for a mile at that gait, while 2:40 was beyond improvement, and yet in a less number of years the record has been successively lowered by $31\frac{1}{4}$ seconds.

Below are given the trotting, pacing, and racing records, amended up to date, December, 1891. The trotting being given first:

Against time—One mile, all ages, Sunol, Stockton, Cal., October 20, 1891, 2:08 $\frac{1}{4}$. In a race—Nancy Hanks, Independence, Iowa, August 27, 1891, 2:12.

Two miles—Fanny Witherspoon, Chicago, September 25, 1885, 4:43.

Three miles—Huntress, Prospect Park, Long Island, September 23, 1872, 7:21 $\frac{1}{4}$.

Four miles—Satellite, Keokuk, Iowa, August 12, 1888, 10:52 $\frac{1}{2}$.

Five miles—Lady Mack, Oakland, California, April 2, 1874, 13:00.

Ten miles—Controller, San Francisco, November 23, 1878, 27:23 $\frac{1}{4}$.

Twenty miles—Capt. Megowan, Boston, October 2, 1865, 58:25.

Fifty miles—Ariel, Albany, New York, May 5, 1846, 3:55:40 $\frac{1}{2}$.

One hundred miles—Conqueror, Long Island, November, 12, 1853, 8:56:01.

One mile, to wagon—Allerton, Independence, Iowa, September 25, 1891, 2:15.

One mile, under saddle—Great Eastern, New York, September 22, 1877, 2:15 $\frac{3}{4}$.

One mile, double team—Belle Hamlin and Justina, Independence, October 24, 1890, 2:13.

One mile, triple team—Belle Hamlin, Globe, and Justina, Cleveland, Ohio, July 28, 1891, 2:14.

One mile, with running mate—H. B. Winship with Gate Case, Providence, August 1, 1884, 2:06.

One mile, yearling—Belle Bird (Electioneer), Stockton, California, October 21, 1891, 2:26 $\frac{1}{4}$.

One mile, 2-year-old—Arion (Electioneer), Stockton, California, October 21, 1891, 2:14 $\frac{1}{2}$.

One mile, 3-year-olds—Sunol, San Francisco, November 9, 1889, 2:10 $\frac{1}{2}$.

One mile stallion—Allerton, Independence, Iowa, September 19, 1891, 2:09 $\frac{1}{4}$.

Three mile heats, in a race—Nancy Hanks, Independence, Iowa, August 27, 1891, 2:12, 2:12 $\frac{3}{4}$, 2:12.

Three mile heats, exhibition—Maud S, Philadelphia, July 26, 1881, 2:12, 2:13 $\frac{1}{4}$, 2:12 $\frac{1}{2}$.

PACING.

One mile, all ages, against time—Direct, Independence, Iowa, September 4, 1891, 2:06. In a race, Direct, Columbia, Tennessee, October 26, 1891, 2:08.

Two miles—Defiance and Longfellow, dead heat, Sacramento, December 26, 1878, 4:47 $\frac{3}{4}$.

Three miles—James K. Polk, Centerville, Long Island, September 13, 1877, 7:44.

Four miles—Longfellow, San Francisco, December 31, 1881, 10:34 $\frac{1}{2}$.

Five miles—Lady St. Clair, San Francisco, December 11, 1874, 12:54 $\frac{3}{4}$.

One mile to wagon—Roy Wilkes, Independence, Iowa, October 30, 1891, 2:13.

One mile, under saddle—Johnston, Cleveland, August 3, 1888, 2:13.

One mile, team—Richball and Westmont, Providence, September 11, 1884, 2:19.

One mile, with running mate—Westmont, Chicago, July 19, 1884, 2:01 $\frac{3}{4}$.

One mile, yearling—Rollo, Jerome Eddy, Independence, October 27, 1891, 2:28 $\frac{1}{2}$.

One mile, 2-year-old—Manager, Nutwood, Independence, August 29, 1890, 2:16 $\frac{1}{4}$.

One mile, 3-year-old—Manager, Independence, September 6, 1891, 2:11 $\frac{1}{2}$.

One mile, stallion—Direct, Independence, Iowa, September 4, 1891, 2:06.

Three mile heats race—Direct, Columbia, Tennessee, October 26, 1891, 2:09, 2:08, 2:08 $\frac{3}{4}$.

Three mile heats, exhibition—Little Brown Jug, Hartford, August 21, 1881, 2:11 $\frac{3}{4}$, 2:11 $\frac{3}{4}$, 2:12 $\frac{1}{2}$.

RUNNING.

Quarter of a mile—Bob Wade, 5, Helena, Montana, September 20, 1891, 0:21 $\frac{1}{4}$.

Three furlongs—Eclipse Jr., 5, Deer Lodge, Montana, July 10, 1891, 0:34 $\frac{1}{4}$.

Half a mile—Geraldine, 4, 122 pounds, Morris Park, August 30, 1889, 0:46.

Five furlongs—Britannic, 5, 122 pounds, August 31, 1889. Fordham, 6, 115 pounds, May 31, 1890. Sallie McClelland, 2, 115 pounds, May 31, 1890. Annie Queen, 2, 110 pounds, July 12, 1891. All at Morris Park 0:59.

Five furlongs and one-half—La Tosca, 3, 111 pounds, Morris Park, June 4, 1891, 1:04 $\frac{1}{4}$.

Three quarters of a mile—Fides, 4, 116 pounds, Morris Park, May 31, 1890, 1:10 $\frac{1}{4}$.

Six and one-half furlongs—Rinfax, 3, 106 pounds, San Francisco, April 30, 1891, 1:20 $\frac{1}{4}$.

Seven furlongs—Lake View, 5, 123 pounds, Chicago, Garfield Park, August 17, 1891; Bella B, 5, 103 pounds, Monmouth Park, straight, July 8, 1890. Both 1:23 $\frac{1}{2}$.

One mile—Salvator, 4, 110 pounds, Monmouth Park, straight course, against time, August 28, 1890, 1:35 $\frac{1}{2}$; Raveloe, 3, 107 pounds, Monmouth Park, straight, July 31, 1890, 1:39 $\frac{1}{4}$; Racine, 3, 107 pounds, Chicago, Washington Park, July 28, 1890, 1:39 $\frac{1}{2}$.

One mile and seventy yards—Whitney, 3, 102 pounds, Chicago, Garfield Park, August 18, 1891, 1:44 $\frac{1}{2}$.

One mile and one-sixteenth—Aloha, 6, 110 pounds; Van Buren, 3, 90 pounds, Chicago, Garfield Park, August 11, 1891. Both 1:46.

One mile and one-eighth—Tristan, 6, 114 pounds, Morris Park, June 2, 1891, 1:51 $\frac{1}{2}$.

One mile and three-sixteenths—Tristan, 5, 102 pounds, Sheepshead Bay, September 4, 1890, 2:00 1-5.

One mile and a quarter—Salvator, 4, 122 pounds, Sheepshead Bay, June 25, 1890, 2:05; Banquet, 3, 108 pounds, Monmouth Park, straight, July 17, 1890, 2:03 $\frac{3}{4}$.

One mile and 500 yards—Ben d'Or, 4, 115 pounds, Saratoga, July 25, 1882, 2:10 $\frac{1}{2}$.

One mile and three furlongs—Ormie, 4, 105 pounds, Chicago (Washington Park), July 7, 1890, 2:20 $\frac{1}{4}$.

One mile and one-half—Firenzi, 6, 117, pounds, Sheepshead Bay, June 26, 1890, 2:33.

One mile and five furlongs—Hindoocraft, 3, 75 pounds, Morris Park, August 27, 1889, 2:48.

One mile and three-quarters—Hotspur, 5, 117 pounds, San Francisco, August 30, 1891, 3:00 $\frac{3}{4}$.

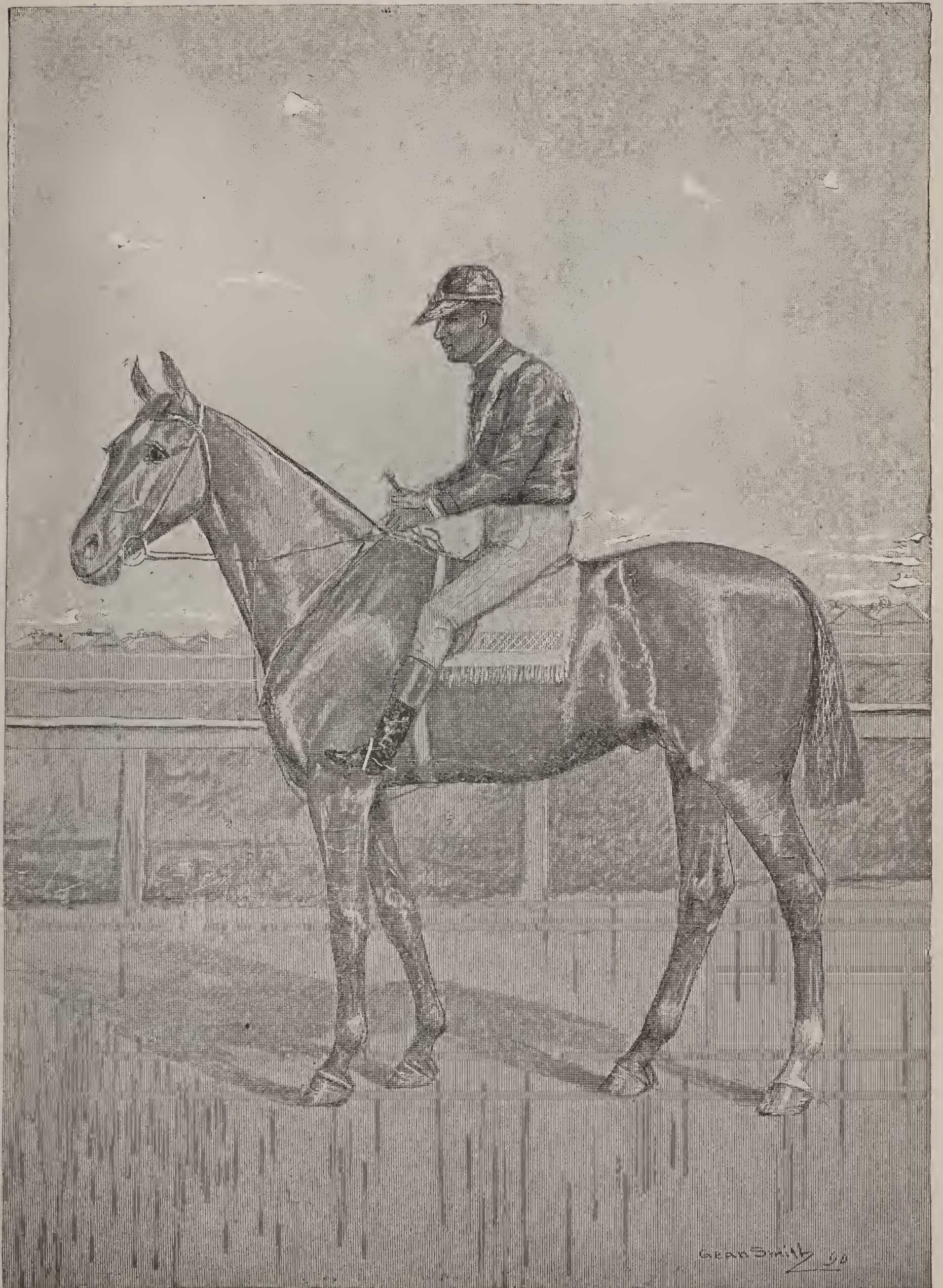
One mile and seven furlongs—Enigma, 4, 90 pounds, Sheepshead Bay, September 15, 1885, 3:20.

Two miles—Ten Broeck, 5, 110 pounds, Louisville, May 29, 1877, against time, 3:27 $\frac{1}{2}$; Wildmoor, 6, Kansas City, September 29, 1882, 3:28.

Three miles—Drake Carter, 4, 115 pounds, Sheepshead Bay, September 6, 1884, 5:24.

Four miles—Ten Broeck 4, 104, pounds, Louisville, September, 27, 1876, against time, 7:15 $\frac{3}{4}$; Fellowcraft, 4, 108 pounds, Saratoga, August 20, 1874, 7:19 $\frac{1}{2}$.

HORSES.



HORSES.



HEAT RACES.

Quarter of a mile—Sleepy Dick, a., Kiowa, Kansas, November 24, 1888, 0:21½, 0:22¼.

Half a mile—Bogus, a., 113 pounds, Helena, Montana, August 22, 1888, 0:48, 0:48.

Five furlongs—Kittie Pease, 4, Dallas, Texas, November 2, 1887, 1:00, 1:00. Studie McNairy, 3, 98 pounds, Chicago, July 2, 1883, 1:02¼, 1:03.

Three-quarters of a mile—Lizzie S., 5, 118 pounds, Louisville, September 28, 1883, 1:13¼, 1:13¼.

One mile—Guido, 4, 117, pounds, Chicago, Washington Park, July 11, 1891, 1:41½, 1:41. Three in five heats L'Argentine, 6, 115 pounds, St. Louis June 14, 1879, 1:43, 1:44, 1:47¾.

One mile and one-sixteenth—Slipalong, 5, 115 pounds, Chicago, Washington Park, September 2, 1885, 1:50½, 1:48.

One mile and one-eighth—Gabriel, 4, 112 pounds, Sheepshead Bay, September 23, 1880, 1:56, 1:56.

One mile and one-quarter—Glenmore, 5, 114 pounds, Sheepshead Bay, September 25, 1880, 2:10, 2:14.

One mile and one-half—Bigaroon, 4, Lockport, July 4, 1872, 2:42¾, 2:43.

Two miles—Miss Woodford, 4, 107½ pounds, Sheepshead Bay, September 20, 1884, 3:33, 3:31¼.

Three miles—Norfolk, 4, 100 pounds, Sacramento, September, 23, 1865, 5:27½, 5:29½.

Four miles—Ferida, 4, 105 pounds, Sheepshead Bay, September 18, 1880, 7:23½, 7:41.

With all the record breaking that has been going on among the trotters there are still only forty-four with records of 2:15 or better. Thirteen of them have retired and six are dead. Fourteen of the records were made on kite tracks. Here is the list:

NAME.	SIRE.	DATE.	RECORD
Sunol, b m(k).....	Electioneer.....	1891.....	2:08¼
Maud S., c m(r).....	Harold.....	1885.....	2:08¾
Nancy Hanks, b m.....	Happy Medium.....	1891.....	2:09
Allerton, br h (k).....	Jay Bird.....	1891.....	2:09¼
Jay Eye See, blk g (r).....	Dictator.....	1884.....	2:10
Nelson b h.....	Young Rolfe.....	1891.....	2:10
Palo Alto, b h (k).....	Electioneer.....	1891.....	2:10
Guy blk g.....	Kentucky Prince.....	1889.....	2:10¾
Stamboul, br h.....	Sultan.....	1890.....	2:11
St. Julien, b g (d)....	Volunteer.....	1880.....	2:11¼
Delmarch, bh.....	Hambrino.....	1891.....	2:11½
Axtell, b c.....	William L.....	1889.....	2:12
Jack gr g (k) (r).....	Pilot Medium.....	1890.....	2:12¼
Margaret S., b f (k)...	Director.....	1890.....	2:12½
Belle Hamlin, b m.....	Hamlin's Alm't jr....	1889.....	2:12¾
Mary Marsh'l, b m (k)...	Billy Wilkes.....	1891.....	2:12¾
Maxey Cobb b h (d)...	Happy Medium.....	1884.....	2:13¼
Rarus, b g (d).....	Conklin's Abd'l'h....	1878.....	2:13¼
R. Rysdyk, b h (k)....	William Rysdyk.....	1891.....	2:13¾
B. McGregor b h (r)...	Rbt. McGregor.....	1889.....	2:13¾
H. Wilkes, b (gr).....	George Wilkes.....	1887.....	2:1½3
Pat Downing, b g (k)...	Abe Downing.....	1891.....	2:13¾
Phallas, b h (r).....	Dictator.....	1884.....	2:13¾
Vic H, br m.....	Reavis' Blackb'd.....	1891.....	2:13¾
Clingstone, b g (r)...	Rysdyk.....	1882.....	2:14
Gol'h Maid, b m (d)...	Alexr's Abdallah.....	1874.....	2:14
Trinket b m (r).....	Princes.....	1881.....	2:14
Homestake, b g.....	Gilbralter.....	1890.....	2:14¼
Nelly W., gr m.....	Rolla Golddust jr....	1891.....	2:14¼
Patron, b h (r).....	Pancoast.....	1887.....	2:14¼
Alvin, ch h (k).....	Orpheus.....	1890.....	2:14½
Arion, b c (k).....	Electioneer.....	1891.....	2:14½
B. Wilmore, b h (k)...	Wilmore.....	1891.....	2:14½
Incas br h (k).....	Inca.....	1891.....	2:14½
R. Wilkes, b m.....	Conn's H. Wilkes.....	1888.....	2:14½
Hopeful, gr g (r)....	Godfrey Patch'n.....	1878.....	2:14¾
Pickpania, b m.....	Pickpocket.....	1891.....	2:14¾
P. Wilkes ch g (r)...	Red Wilkes.....	1888.....	2:14¾
Alabas'r gr c (k) (d)...	Aberdeen.....	1890.....	2:15
Arab, b g (r).....	Arthurton.....	1888.....	2:15
Charleston, ch h (k)...	Bourbon Wilkes.....	1891.....	2:15
Favonia, bm (d).....	Wedgewood.....	1888.....	2:15
Lula, b m (d).....	Alexdr's Norman.....	1875.....	2:15
Majolica, b g (r).....	Startle.....	1885.....	2:15

(r) retired, (d) dead, (k) kite track records.

We present with this article illustrations of various classes of horses. Each one may be taken as one of the best specimens of his kind. The Percheron draught-horse is represented by the magnificent imported stallion, Brilliant, whose get are known and justly held in high esteem all over the country. The running-horse is represented by that grand-muscled, deep-chested animal,

Norfolk, whose long-distance dashes are unsurpassed in racing annals. The trotter has for his exponent that marvelous three-year-old, Axtell, whose performance at Terre Haute has been surpassed by only two horses, and never equaled by a trotter of the same age, being only ¾ seconds higher than the best time ever made by any trotting-horse of any age. The carriage-horse is represented by the imported French coach stallion, Indre, a prize winner at the Paris exposition. In connection with the breeding of fine horses it may be well to state that the largest breeding farm in America is "Oaklawn" (owned by M. W. Dunham), at Wayne, Du Page county, Ill., where many of the finest horses of the country have been bred. There are, however, many other breeding establishments in the United States, for the fondness for fast horses has come to stay.

Stable Management.—In treating of this part of the subject, it is assumed that the stable is in a healthy situation, for in an unhealthy one trouble or expense will be simply thrown away. Horses dislike bad smells; the drainage of the stable should therefore be well looked to, and the traps should be as far from the stable as circumstances will permit. The pit for the reception of the manure and foul litter, which should be constantly removed, should also be some distance from the stable.

Stalls should not be less than six feet wide; if three inches more can be had so much the better. The partitions should be long enough to prevent horses kicking each other, and high enough, toward the head, to prevent them biting one another. Some authorities recommend that the partitions be so arranged that horses cannot see each other; it makes them restless they say. The soundness of this advice is open to question; it may perhaps hold good with regard to race-horses; but the horse is fond of company, and certainly horses that are driven together, or ridden in company, seem to like the society of their fellows in the stable, while a stable companion is useful to lead young horses over fences in their early attempts at leaping.

In dealers' stables the floor of the stalls often slopes considerably from front to back. This makes a horse look bigger than he really is, but it throws all the strain of supporting the body onto the back tendons, and should not be permitted in private stables. A fall of two and a half inches is more than enough for the purposes of draining.

As regards the internal arrangements, especial care should be paid to light, ventilation and temperature. A sufficient amount of light is indispensable for the health of the horse. Horses, like men, are greatly influenced by surroundings, and, considering the number of hours in the week spent indoors, a horse can no more thrive in a dark stable than a man in a dark room. Moreover, a horse brought out of a dark stable is much more likely to shy than one whose eyes had not been dazzled by the sudden change from dark to light. Dark stables were once thought to be conducive to good feeding, and to making a horse lie down, but the idea is now exploded. The horse-owner may here be warned against seeking to make up for a deficiency of natural light by having the whole of the interior of the stable whitewashed. To the height of seven feet from the ground the walls should be colored with some neutral tint, that the horse's eyes may not be injured by the glare inseparable from whited walls. Dark stables encourage carelessness in the groom, the result being an accumulation of dirt; and, even if the stableman be an honest worker, he cannot see to clean the floors and corners properly unless light be freely admitted to the building.

In the ventilation of stables many theories have been

propounded, and many appliances suggested, but most of the latter have failed from letting in cold currents to a greater extent than they let out the foul air. In nineteen cases out of twenty, the ventilation of private stables consists of holes in the brickwork. In using these it will be found advisable to have thin pieces of zinc, with felt edging to prevent noise, and with easy working hinges, nailed outside the wall, to act as valves; then should the wind set from the quarter in which the ventilators are situated, the zinc coverings will be blown against the apertures, and the entrance of cold currents to any great extent thereby hindered. When the stable is empty doors and windows should be thrown open if the weather allow it to be done without reducing the temperature too much. These remarks on ventilation apply chiefly to smaller stables built in the vicinity of a dwelling-house; in the case of stables built in open spaces, for the reception of a large stud, recourse will generally be had to the advice of a civil engineer on the question of ventilation, but even then experience has shown that the difficulty will not be wholly overcome. The apertures in the walls for the escape of foul air, which, being lighter than fresh, ascends, should in no case be less than seven feet from the ground. If the ventilators are lower than this there will be a current of cold air blowing on the horse's body, which would be injurious at all times, but especially when the horse comes in warm from work.

Temperature is of course an important matter, but chiefly so during the colder portions of the year. In summer it is all but impossible to keep stables cool when the thermometer is standing at 80° Fahr. in the shade; still if the situation is favorable to coolness, and the temperature can be kept below 70°, so much the better. During the hunting season, stables may be too warm by accident or from design; they may be overheated owing to insufficient ventilation, or because the groom connects a glossy coat with a stable bordering on tropical heat. About 55° Fahr. is a good mean temperature, but this cannot of course be maintained when the outside air is some 10 or 15 degrees higher; the most that can be done is to keep the temperature up to that point in cold weather. A moderate temperature and moderate clothing are better than too low a temperature with excessive covering, or too high a temperature with but little clothing.

Having mentioned clothing incidentally, it may here be said that the best shape is the ordinary sheet, cut out at the neck, and buckled across the chest; the sheet should be long enough to reach the root of the tail, and should be large enough to buckle easily round the chest; if it be tight the hair will be rubbed. Some people prefer a straight rug that does not buckle, the front being formed of a separate breast cloth. Hoods are only needed when at exercise in bad weather, or when the horse is traveling by railway. Particular care should be taken that the roller does not touch the back bone; the pads should be so placed that there is a clear space of four inches between them, so as to leave a clear channel over the back bone. The neglect of this precaution will inevitably produce a sore back, and, while first of all making the horse shy of being touched, may subsequently make him vicious in the stable.

Regularity is absolutely indispensable to successful stable management; without it, the horse may be subjected to a dozen different kinds of treatment in as many days, a course obviously detrimental to his health.

The engagement of a good groom is the first step. Where there is a stud of ten or more horses, a stud groom will probably be kept, and, as he will not do much work himself—indeed, it is better that he should not—he

should know how things ought to be done, and see that they are done. In small establishments, however, there will be but one or two men; but the head one should be a thorough stableman. The more ignorant he is of the veterinary art the better; indeed, every horse-owner should, in the strictest terms, forbid his servants to administer any drug or medicine whatever without permission; and the owner himself may be advised never to sanction the giving of any physic, but always to seek good professional advice if any signs of sickness are visible.

Stable work should commence early, as soon after 6:00 A.M. as possible. The first duty is to examine each animal carefully, to discover whether any injury has been received during the night from kicking, getting cast, or any other cause. Horses are then fed and watered, the litter is turned up, that which has been in use during the night not being allowed to remain in the stable during the day, and the stable is put in order; exercise succeeds, after which the animals are thoroughly dressed, but the dressing should never be performed out of doors. Feeding takes place again at 12:00 noon, 4:00 P.M. and 8:00 P.M., when the horses are done up for the night.

Of the feeding of race-horses nothing need be said here, as their care is a business of itself, with which the private person has nothing to do.

Oats and hay form the diet upon which horses are kept, to which beans are added for hunters and horses in hard work; while bran, linseed, and carrots are used for special purposes, in addition to, or sometimes in substitution for, the regular food. Hacks and horses in light work will do well on a daily allowance of eight to ten pounds of oats and ten or twelve pounds of hay. Beans, which contain about 30 per cent. of nutriment, are heating, and should be given only now and then in small quantities. The oats are best divided into four feeds, and beans when used should be given at the midday and last feeds. A handful or two of chaff is useful with each feed, as it compels a horse to masticate, but in many stables there is a prejudice against it, and the hay is put into the rack four times a day, not more than three pounds being given at one time. Oats should be bruised; but, as they soon turn sour, it will be best to bruise every morning only as much as will suffice for the day's consumption.

Bran is indigestible, but it is a laxative, and, so far as hunters are concerned, it is only given in the form of a mash after a day's hunting, and on Saturday nights. To make a bran mash, put half a pint of linseed in a pan, pour a quart of boiling water upon it, and let it soak for four hours; then take about two and a half pounds of bran and mix with it enough hot water to saturate it; stir the linseed composition into this, and it is fit for use. Should the mash be put in the manger, the latter should be scoured out with hot water afterward, or the sourness of the remains of the mash will make many horses refuse their corn.

A few carrots, which must be carefully washed and scraped, given every now and then, are useful as tending to keep the blood in good order, and checking any symptoms of fever induced by the dry food upon which horses live.

Maize or Indian corn contains so small a proportion of nutritious matter that it is not fit for hunters or for horses from which fast work is required.

A correct system of watering horses is no less important than proper feeding with dry food. Many grooms, in their horror at giving too much, fall into the opposite extreme, and stint the horses under their care to an extent that is positively cruel. The result of such a system is fever in various shapes, and a general loss of condition. There has of late years been a growing

tendency to favor the plan of letting horses have access to water at all hours of the day and night, and experience has shown that the effect is beneficial. A separate tank in the stall or loose box is fed by a tap, and a constant supply should be kept up. If a horse watered on this plan be watched, it will be seen that he never takes more than a very few small mouthfuls at a time, nothing like the quantity allowed by the most stingy groom; and, if the amount consumed be measured, it will be found that, after the first day or two, the horse actually drinks less than when watered at stated intervals. Where the *ad libitum* plan is not adopted, horses should be watered four times a day. Nothing can be more unwise than the undue stinting hunters of their water on hunting days; no one could expect a satisfactory day's work from an animal suffering from excessive thirst. Where horses can have water when they like, it will scarcely be necessary to do more than to put the cover on the water tank at about 9:30 on hunting morning, assuming the meet to be at 11:00. It need hardly be said that the quality of water supplied to stables should be carefully attended to. Horses are easily made sick by impurities, and are very dainty in their choice of water. When on a journey, horses should never be allowed to drink at public troughs, as disease is very likely to be contracted by such a proceeding.

Exercise is a great preservative of health, but, like food and medicine, it should be given at proper times and in proper quantities. Exercise must not be confounded with work; the severe work horses are sometimes called upon to perform takes much out of them, and exercise is one of the means adopted to counteract any ill effects of hard work. In order that the muscles of a horse may not become prematurely tired, it is not sufficient that they should be violently taxed some three days a fortnight as with hunters; they must be used every day, and the exercise by which this is effected causes all the tissues of the body to receive their support by reason of the tone given to the circulation of the blood. Hacks, harness horses, and particularly ladies' horses, should be sufficiently well exercised to guard against an excessive exuberance of spirits; for nothing is more annoying than to have an animal, quiet enough in an ordinary way, perpetually jumping about at the approach of vehicles or other horses, merely because he is too fresh. Hunters should have two hours' walking exercise daily; sometimes a slow trot of three or four miles may be indulged in, but, when the hunting season fairly sets in, and horses are hunted regularly, cantering should be forbidden at exercise unless either master or man happens to be a very good judge of what kind of exercise a horse requires.

Horsemanship.—The first step in horsemanship is to mount a horse; but for the performance of this apparently simple feat no fixed rule can be laid down for the guidance of the civilian. Having taken up the reins, the rider should stand at his horse's near shoulder facing toward the tail, and in that position hold the stirrup with his right hand for the reception of his left foot. By standing at the shoulder the rider is out of harm's way in the event of the horse kicking while he mounts. It is perfectly easy to carry out these directions when the man and horse are both of middle height; but it is simply impossible for a short man to mount a horse of sixteen hands high in such a manner; he must risk the kick and stand where he can reach the stirrup—behind it. Having gained the saddle the necessity arises for seat and hands. The fact that the seat of a civilian rider must vary to some extent according to the size and shape of the animal upon which he finds himself does not preclude certain principles from applying in the formation

of it, and it is toward the proper understanding of these principles, and the adoption of the right position of the legs and body, that good instruction is desirable at the outset.

The great desideratum in a seat on horseback is that it should be firm, and this for two reasons. In the first place, a rider with an insecure seat is apt to be thrown by any unexpected movement the horse may make, such as a slight stumble or shying; and secondly, without a firm seat the acquirement of good hands is well nigh hopeless, because when the balance is once disturbed, the rider will have to depend on something else for the maintenance of his seat, and this other means of support will generally take the shape of "riding the bridle," a practice as much opposed to good horsemanship as it is injurious to the horse's mouth.

Having gained the saddle, the rider should seat himself in the middle of it, and should never allow any part of his person to overlap the cantle, as is but too often seen. Many rules are given for adjusting the stirrups to the proper length before mounting, but in practice they are not to be depended upon—first, because all men are not made in quite the same proportions; secondly, where two men are of equal height, the man with the thicker and rounder legs will require a shorter stirrup than the one with lean and flat legs; and thirdly, men of any build will need a shorter stirrup on a wide horse than on a narrow one, besides which, if a horse pulls at all, another hole or two will give the rider additional power over his animal. The proper length of stirrup, then, cannot be satisfactorily ascertained till the rider is mounted. Sitting well in the middle of the saddle, the thighs being turned in, and the heels drawn somewhat back, the stirrup leathers may be let out or taken up until the tread of the stirrup is on a level with the inner ankle bone, and at this length, when the rider stands up, his fork will clear the pommel of the saddle by about three inches. For maintaining his seat the horseman should depend upon his thighs and knees, and not upon the knee and calf only; at times, of course, when on a restive horse, every available muscle may have to be brought into play, but the proper rule is as stated. Some people say they ride by balance only, and others that they ride by grip; a proper seat should be an admixture of the two: a man riding by balance only is sure to be kicked off, while to grip with all one's might during an hour's ride is to undertake as much exertion as should last for a whole day. The position of the foot exercises some influence on the security of the seat; at one time it was thought proper to turn the toes in and depress the heel, a posture that tended to diminish the grip of the thighs, but now the toe should be turned a little outward, and but very little upward. A good seat on a horse should not be strong merely; it should be as graceful as the make and shape of horse and rider allow; but it should not be a stiff, stuck-up seat, which is never graceful, because it is not natural. Above the loins the body should be loose, so as readily to adapt itself to every motion of the horse; but it should be upright, for if the rider lean forward in his saddle, a false step on the part of the horse is very apt to send him flying over its head. The position of the hands has a great deal to do with the seat, but the hands and the reins will be treated of presently,

Beginners are often advised to learn to ride without stirrups; if they do, they should have no saddle either, for riding in a saddle without stirrups is likely to produce rupture. The soundness of this advice, however, may be questioned, because, although riding without stirrups will undoubtedly tend to a firm seat, it will not be one of the same sort as when stirrups are

used; there must therefore be a process of learning and unlearning. The better plan is to practice both ways concurrently. Thus let the pupil be properly placed in a saddle with stirrups, and when he has ridden half an hour let a cloth be substituted for the saddle for about ten minutes, care being taken to observe the rules already laid down for the position of the legs; in this way the proper seat will be strengthened, instead of a new one being formed.

The proper adjustment of the reins is the next thing to be attended to, and as the management of these depends so much upon the seat being firm and independent of the bridle, the acquisition of a firm seat is certainly half way toward the acquirement of good hands. Assuming a single rein snaffle to be the bridle used, the second, third, and fourth fingers of the left hand should be inserted between the reins, which should be drawn up gently with the right hand until the rider feels that he has got an equal hold of his horse's mouth on both sides, and with just so much pressure that the slightest movement of the left or right rein would cause him to turn to the left or right respectively; the fore and middle fingers of the right hand should then take hold of the right rein, which may be drawn out from the left hand so as to enable the hands to be held about four or five inches apart. The arms from the shoulder to the elbow should hang naturally close to the sides, and the arms from elbow to wrist should be about parallel to the ground, the wrist being kept loose, so as to yield gently with every motion of the horse. The rider sitting in the position described, square to the front, with his shoulders well back, will be riding with fairly long reins, one of the secrets of good hands; if he stoops forward and carry his bridle hand at some distance in front of his body, so as to take a short hold of his horse's head, seat and hands will both be bad.

When a double-reined bridle is used, the third finger of the left hand should be first inserted between the snaffle reins, and then the little, third, and second fingers should be between the curb reins, the two outside reins will then be the curb, and the two inside ones the snaffle. In this manner of holding the reins the snaffle is not so likely to slip, while the curb can be easily slackened or drawn tighter. As military riders invariably use the curb only, the position of snaffle and curb as just explained is reversed in the cavalry service.

When the horse is in motion, the hands should not be kept in one spot, so as to act like the peg on the pad of a harness-horse to which the bearing rein is fastened, as the mouth would thereby become dead, and the horse would lean unpleasantly on the bit; but the rider should give and take, so that while the pressure is not stronger at one moment than another (unless there be a reason for it), yet, on the other hand, the hold should never be entirely relaxed.

In order to encourage the horse to walk, the head must not be confined, but the light feeling on the horse's mouth must be kept up. Should the horse break into that uncomfortable pace, a jog trot, which, by the way, a well-broken hack should not do, never snatch at his mouth, but restrain him gently. To trot, press the legs to the saddle, raise the bridle hand a little, and urge him, if necessary, with the voice. The rising to the trot should be performed easily; the legs must not swing backward and forward, nor should the hands be jerked up and down, while the action of the rider should be in perfect time with the motion of the horse, or a passer-by may remark that the horseman is riding faster than his horse. To start in the canter take up the curb rein a little and turn the horse's head slightly to the right, at the same time pressing the left leg behind the saddle; the horse will then lead with the off fore leg, which is

generally preferred under ordinary circumstances; but a well-broken hack should be taught to lead with either, and if he be cantered in a circle to the left he must lead with the near leg, as otherwise an ugly fall is likely to result from the leg being crossed. Galloping is a pace not generally indulged in by hack riders; when it is, the hands should be kept low, the body thrown back, and an extra grip taken, as nearly all horses pull more or less when extended.

HORSE-SHOEING. That in a state of bondage, as a burden-carrying animal, traversing hard roads, the horse must necessarily be shod to prevent a foot-wear beyond the powers of nature to recuperate is now universally admitted. In other words, horse-shoeing is a necessary evil. In a state of nature the hoof is by attrition and wear kept in such a condition that the strain of the animal's mere bodily weight is properly distributed, and the lameness which often results from improper shoeing is obviated. Any deviation from this natural position and conformation of the hoof must result in harm to the animal, and hence it becomes a question of prime importance to discover what is the true position of a horse's hoof, and of what relative value the various parts are to each other, and what office each portion of the hoof performs. This question is best solved by a careful study of a hoof from a young horse which has never been the subject of the art of the farrier, and the best individual specimens are naturally those of colts which have ranged in upland pastures. The great question which divides the authorities on horse-shoeing is as to the office of the frog — one party maintaining that the frog of the foot bears an equal share with the walls of the hoof in sustaining the weight of the animal, and the other side declaring that only the walls are involved in the fulfillment of this function. Both sides of the question have many eminent advocates. Laying aside for a time the discussion of the merits of either position, we lay down the broad proposition that the true art of horse-shoeing consists in so arming the hoof with iron that the natural offices of its parts may not be interfered with, that those parts which nature designs to protect shall be protected, and those parts intended to bear the strain of the animal's weight shall be so covered as to allow that function to be performed without undue stress on one part and undue exemption on another. To recur to our inspection of a hoof in a state of nature: The hoof of an upland pony is found to be surrounded by a dense, tough horny wall. The growth of the horn at the heel is marked; in the quarters there is a decrease of the growth, and at the toes is exhibited the greatest growth. Of course we speak only of the *downward* growth of the horny substance. It will thus be seen that the form of a horse's foot is in so far analogous to that of the foot of a man. It has a toe, a hollow, and a heel; and the heel and toe bear the main stress of the animal's weight, *i.e.*, speaking of the external structure of the foot alone. The terminal bone of the horse's foot and leg is the coffin bone, which the horny wall incloses. To this coffin bone are attached the extensor and flexor tendons, and it is furnished on its superior surface with ridges of bone to which are attached an expansive tough cartilage, which dovetail into horny ridges on the interior surface of the horny wall of the hoof. This cartilage and their horny attachments are technically called the "sensitive" and "insensitive" laminae, and upon them depends the entire weight of the horse. This discovery, demonstrated by eminent veterinary surgeons, goes to show, in connection with the peculiar growth of the horse's horny hoof, that the outer walls of the foot are the main factors in bearing the horse's weight. Having reached this point, veterinary surgeons began to inquire into the

office of the frog. The frog is located nearer the ground than the sole of the foot, and is much more spongy and elastic in its tissue.

It is joined to the sole by thin commissures (ridges) of horn, and this structure of the foot admits of a lateral expansion of the foot at the heel, rendering the hoof much more elastic and able to resist concussion. But this is not the only provision of nature to destroy or minimize the concussion on a horse's hoof in running. The "sensitive laminæ" are found to be elastic and compressible, their variation in size under pressure and free from pressure being nearly one-quarter of an inch, and as there are 700 of these laminæ in a hoof, the result is a wonderful elastic cushion between the end of the leg and the external hoof. But to render this arrangement yet more effective, if the weight should be sufficient to cause expansion of the foot to such a degree as to enable the frog to touch the ground, the very fact that it does touch teaches us that it is intended to act as a soft cushion between the ground and sole of the foot, destroying and overcoming the last vestige of shock which the insensitive laminæ and foot expansion had left to be overcome. These facts being established, we next consider how we shall shoe a horse to preserve these conditions intact, and we deduce, first, that the wall must be perfectly level—*i.e.*, that no more shall be taken from one side of the foot than the other; and this is determined by measuring from the ground to the coronet (where hoof joins skin) on each side of the heel, care being taken to repeat such measurements all around the hoof at points opposite each other, the distance from the ground to coronet being made to agree at any two points on opposite sides of the hoof. Next the hoof must be balanced, or in other words from a line drawn through the longer axis of the frog, the measurements to points opposite should be the same on both sides of the foot. This means simply that the line drawn longitudinally through the frog must at all points be the longitudinal center of the entire foot, or divide it into two exact halves. Next the paring of the walls at the heels and toes demands attention. This should be done with due regard for both tendons and bones. If the heels are allowed to grow too high the main strain is thrown on the bones, while if the toes are too high the tendons suffer in like manner. If one heel is higher than the other corns result, as they do also from too long toes sometimes. Long toes are also liable to produce a rupture of the tendons from the cannon bone, an accident ruinous and incurable. No arbitrary rule can be given for regulating the height of heel and toe. This knowledge must be the result of long experience, and the work is done when done intelligently with due regard to the inclination of the pastern joints, which vary more or less in almost every individual horse. The only general rule to be laid down is that the line of the inclination of the axis of the pastern and that of the hoof should correspond. In regard to paring the frog of the foot, it is imperatively insisted by the best authorities that the frog shall not be touched except to remove ragged edges. Paring the frog is reprehensible enough to cause the instant discharge of a workman guilty of such an offense. As to the sole, various opinions exist as to the advisability of paring it, but the best authorities generally coincide in the doctrine that the sole should be pared to correspond with the concave form of the part generally seen in young horses. The condition of the sole is largely dependent on the wall of the hoof. The only general rule that can be given on this point is that the sole should not be allowed to touch the shoe unless the wall be too weak to bear the strain of the horse's weight.

The various patents of horseshoes are numerous,

many worthless and a few good. Among the good may be mentioned Bonner's four-calk shoe, Charlier's Periplanter, Roberge's Rolling-motion Ball shoe and Harris' Centennial Wing-heeled shoe. Two things must be insisted on by the horse-owner. One is that the shoe shall be as light as possible, and the other, that it shall be held on by as few nails as will answer the purpose. Five nails will answer for saddlers and carriage-horses, and seven will be ample for heavy draught-horses. The nails should be hot-forged, and should be driven with a low inclination rather than high up in the wall; for in the latter case there is a great danger of wounding the sensitive portions of the foot. If the nail be inferior, it is liable to split, and the splinter will enter the fleshy portion of the foot, and occasion great trouble—lockjaw in some cases resulting. The use of cold rolled or cut nails cannot be too strongly reprobated.

HORSE-CHESTNUT, a genus of trees or shrubs indigenous to North America and mountainous regions in Mexico, New Granada, Persia, North India, and the Malayan peninsula, of the natural order *Sapindaceæ* and sub-order *Sapindeæ*, having exstipulate, opposite, digitate, five to nine lobed leaves, an irregular campanulate or tubular five-lobed calyx, four to five petals, five to eight stamens, one style, a three-celled ovary, with six ovules, of which three or more abort, exalbuminous seeds, and a smooth or echinate coriaceous capsule. The Common Horse-chestnut, has been stated to be a native of Thibet, and to have been brought thence to England in 1550; it is now, however, thought to be indigenous in the mountains of northern Greece, where it occurs wild at 3,000 to 4,000 feet above sea-level.

The wood of the horse-chestnut is soft, and serves only for the making of water-pipes, for turner's work and common carpentry, as a source of charcoal for gunpowder, and as fuel. The bark has been employed for dyeing yellow and for tanning, and was formerly in popular repute as a febrifuge and tonic. The powder of the dried nuts was at one time prescribed as a sternutatory in the Edinburgh *Pharmacopœia*. It is stated to form with alum-water a size or cement highly offensive to vermin, and with two parts of wheaten flour the material for a strong bookbinder's paste. Infusion of horse-chestnuts is found to expel worms from soil, and soon to kill them if they are left in it.

HORSE-MACKEREL is the name applied to a genus of fishes (*Caranx*) found in abundance in almost all temperate and especially in tropical seas.

HORSSENS, a seaport town of Denmark, in the province of Aarhus and amt of Skanderborg, is situated at the head of the Horsens-fiord on the east coast of Jutland, and on the railway from Fridericia to Långaa, twenty-five miles southwest of Aarhus.

HORSE-POWER is the name given to the unit in terms of which engineers measure the power of steam-engines, water-wheels, and other prime movers. It is defined to be the rate at which an engine works when it does 33,000 foot-pounds of work per minute, a foot-pound being the amount of work necessary to raise a pound weight a foot high. We must go back to the early history of the steam-engine to discover the reason why this number was adopted. The first steam-engines were employed to drive mills, pumps, and other machinery which had previously been driven by horses; and it seemed natural to express their working-power in terms of the number of horses whose work they were got to accomplish. This led to experiments being made in order to get an estimate of the average working-power of a horse. Several such estimates have been given, all differing considerably from each other; but the one adopted whereby to express horse-power is

that obtained by Boulton and Watt from observations on the strong dray-horses employed at the London breweries working eight hours a day. They found that a horse was able to go at the rate of two and one-half miles per hour, and at the same time raise a weight of 150 pounds by means of a rope led over a pulley. This is easily seen to be equivalent to 33,000 pounds raised one foot per minute, and hence the number given above. In connection with this subject it is necessary to distinguish clearly between "horse-power indicated" and "horse-power nominal," as applied to steam-engines. The horse-power indicated is got from an examination of the indicator diagram.

HORSERADISH, a perennial plant of the natural order *Cruciferae* and tribe *Alyssineae*, having radical leaves on long stalks, ovate or oval-oblong, four to six inches broad, about a foot in length, subcoriaceous, crenate or serrate, and coarsely veined, stem-leaves short-stalked or sessile, elongate, and tapering to their attachment, the lower ones often deeply toothed; flowers, which appear in May and June, three-eighths inch in width, in flat-topped panicles, with sepals purplish, and petals white; and fruit a small silicula, which in the climate of England seldom bears seed. It possesses stomachic, diaphoretic, and diuretic properties, and hence is administered in atonic dyspepsia, chronic rheumatism, and dropsies. As a masticatory, or in the form of syrup or infusion, it is used for hoarseness. Gerard speaks of it as an anthelmintic and emetic. Externally applied it acts as a rubefacient; and the juice with vinegar is a popular remedy for freckles. In common with other species of *Cochlearia*, the horseradish was formerly in high repute as an antiscorbutic.

HORSETAIL, the sole genus of the natural order *Equisetaceae*, consists of a group of vascular cryptogamous plants remarkable for its resemblance in general appearance to the phanerogamic genera *Casuarina* and *Ephedra*. The apparent roots consist of underground stems, any portion of which broken off is capable of producing a new plant; hence the difficulty of eradicating them when once established. There are twenty-five known species of the horsetail, and the genus is universally distributed.

HORSHAM, a parliamentary borough and market-town of Sussex, England, is pleasantly situated in the midst of a fertile country near the source of the Arun and on the Mid-Sussex Railway, thirty-seven and one-half miles south of London.

HORSLEY, JOHN (c. 1685-1732), a distinguished antiquary of the last century, the date and place of whose birth as well as his parentage are uncertain. The late Rev. John Hodgson, the historian of Northumberland, in a short memoir of him published in 1831, countenances the belief that he was born in 1685, at Pinkie, in the parish of Inveresk and county of Midlothian. This statement he reconciles with Horsley's subsequent history, by supposing that his father was a Northumberland Nonconformist, who had migrated to Scotland during the reign of Charles II. or James II., but returned to England soon after the Revolution of 1688. On the other hand, Mr. J. H. Hinde, in "Notes" on the life of Horsley, printed in the *Archæologia Æliana* for February, 1865, leans to the opinion that he was a native of Newcastle-on-Tyne, and the son of Charles Horsley, a member of the Tailors' Company of that town, an opinion to which color is given by some expressions of Horsley's own in the *Britannia Romana*.

Horsley undoubtedly received his early education at the grammar school of Newcastle, and completed it at the university of Edinburgh, where he was admitted to the degree of master of arts on the 29th of April, 1701. For years afterwards nothing seems to be

known of him, though some of them must have been given to the study of theology in connection with the body of dissenters to which he belonged. There is some evidence tending to show that Horsley "was settled in Morpeth as a Presbyterian minister as early as 1709." Mr. Hodgson, however, thinks that up to 1721, at which time he was residing at Widdrington, "he had not received ordination, but preached as a licentiate." Even if he was ordained then his stay at the latter place was probably prolonged beyond that date; for he communicated to the *Philosophical Transactions* notes on the rainfall there in the years 1722 and 1723. Mr. Hinde also shows that during these years, in addition to his other duties, whatever their nature, "he certainly followed a secular employment as agent to the York Buildings Company, who had contracted to purchase and were then in possession of the Widdrington estates." Soon after settling at Morpeth, Horsley began to supplement his professional income, probably slender, by opening a private school. The enterprise was successful. He likewise found time to give courses of lectures on mechanics and hydrostatics in Morpeth, Alnwick, and Newcastle; and it was doubtless in recognition of his scientific tastes and attainments that he was elected on the 23d of April, 1730, a Fellow of the Royal Society.

It is, however, in connection with his archæological researches that John Horsley is now so well and so honorably known, though strangely enough no place appears to have been hitherto found for his name in such works as the present. His great work, *Britannia Romana, or the Roman Antiquities of Britain* (London, 1732), one of the scarcest and most valuable of its class, contains the result of an amount of patient labor in this extensive field that in the case of a man in his position is truly marvelous.

Horsley died suddenly, of apoplexy, on the 12th of January, 1732, his constitution having been in all likelihood prematurely worn out by the toil he had undergone in the composition of the *Britannia Romana*, then on the eve of publication.

HORSLEY, SAMUEL (1733-1806), a learned Anglican prelate, was born in London in 1733. Entering Trinity College, Cambridge, he became LL.B. in 1758 without graduating in arts, and in the following year succeeded his father in the living of Newington Butts in Surrey. Horsley was elected a Fellow of the Royal Society in 1767, but in consequence of a difference with the president he withdrew from it in 1784. He had been secretary since 1773. In 1768 he attended the eldest son of the earl of Aylesford to Oxford as private tutor; and, after receiving through the earl and Bishop Lowth various minor preferments, which by dispensations he combined with his first living, he was installed in 1781 as archdeacon of St. Albans. In 1774 the university of Oxford conferred on him the degree of LL.D. Whilst archdeacon, Horsley entered upon his famous controversy with the Socinian, Dr. Priestley, who denied that the early Christians held the doctrine of the Trinity. In this controversy, conducted on both sides in the fiercest polemical spirit, Horsley showed the superior learning and ability. His aim was to lessen the influence which the prestige of Priestley's name gave to his views, by proving from his writings the latter's incompetence through ignorance to form an authoritative judgment on the disputed points. For the energy displayed in the contest Horsley was rewarded by Lord Chancellor Thurlow with a prebendal stall at Gloucester; and in 1788 the some patron procured his promotion to the episcopal

see of St. David's. As a bishop, Horsley was energetic both in his diocese and in parliament. The efficient support which he afforded the Government in the latter place was acknowledged by his successive translations to Rochester in 1793, and to St. Asaph in 1802. With the bishopric of Rochester he held the deanery of Westminster. He died at Brighton on October 4, 1806.

Besides the controversial *Tracts*, which appeared in 1783-84-86, and were republished in 1789 and 1812, Horsley's more important works are:—*Apollonii Pergæi Inclinationum Libriduo*, 1770; *Remarks on the Observations . . . for Determining the Acceleration of the Pendulum in Lat. 70° 51'*, 1774. *Isaaci Newtoni Opera quæ extant Omnia*, with a commentary, 5 vols. 4to, 1779-84; *On the Properties of the Greek and Latin Languages*, 1796; *Disquisitions on Isaiah xviii.*, 1796; *Hosea, Translated from the Hebrew, with Notes*, 1801; *Elementary Treatises on . . . Mathematics*, 1801.

HORSLEY, WILLIAM (1774-1858), an English musician of considerable reputation, was born November 15, 1774, and became in 1790 the pupil of Theodore Smith, an indifferent musician of the time, who, however, taught him sufficient to obtain the position of organist at Ely Chapel, Holborn. This post he resigned in 1798, to become organist at the Asylum for Female Orphans, as assistant to Dr. Callcott, with whom he had long been on terms of personal and artistic intimacy, and whose eldest daughter he married. In 1802 he became his friend's successor upon the latter's resignation. Besides holding this appointment he became in 1812 organist of Belgrave Chapel, Halkin Street, and in 1837 of the Charter House. He died June 12, 1858. His glees "By Celia's arbor," "O nightingale," "Now the storm begins to lower," and others, are amongst the finest specimens of this peculiarly English class of compositions. Horsley's son (Charles Edward), born in 1822, enjoyed a certain reputation as a musician. He studied in Germany under Hauptmann and Mendelssohn, and on his return to England composed several oratorios and other pieces, none of which had permanent success. In 1868 he emigrated to Australia. He died March 2, 1876, at New York.

HORTEN (KARLJOHANSWÆRN), a seaport town of Norway, in the amt of Jarlsberg-Laurvig, is beautifully situated on the west bank of the Christiania fjord, opposite Moss, and thirty-two miles south of Christiania.

HORTENSE, queen of Holland, is familiarly known as La Reine Hortense. Her proper name was Eugénie Hortense de Beauharnais, and she was the only daughter of Alexandre de Beauharnais and Josephine Tascher de la Pagerie. She was born on April 10, 1783. When four years old she accompanied her mother to Martinique, and returned with her three years later to be subjected to all the dangers of the Revolution. For a time she was sent with her brother to England, but soon returned. The marriage of her mother to Napoleon Bonaparte naturally altered her prospects altogether, and, as she grew to woman's estate, several marriages of more or less importance were proposed for her. It suited the first consul, however, that she should marry his brother Louis, and despite her tears and entreaties the marriage was concluded. In one of his moments of brutal frankness Napoleon confessed that his brother as a husband was "insupportable," though he characteristically proceeded to charge Hortense with having been the cause of her own misfortunes in not agreeing with her husband. Louis, it appears, was sincerely anxious to

please his young wife. But his health was bad and his temper gloomy, while Hortense was exceptionally lively and fond of gayety. The natural consequence was an infinity of scandal, some of it of a very grave character. The recent publication of Madame de Rémusat's memoirs has, however, gone far to exonerate Hortense. The writer, equally outspoken and well informed, gives instances of the most fantastic and disgusting exercise of conjugal tyranny on Louis' part, and denies that his wife in any way misconducted herself, the malignant jealousy of the Bonaparte sisters being credited with the accusation. Within seven years of her marriage, Hortense had three children, whose nomenclature, unless carefully studied, is somewhat puzzling. The eldest, Napoleon-Louis-Charles, was born in 1802 and died in 1807. The next, Napoleon-Louis, was born in 1804 and died in 1831. The third, Charles-Louis-Napoleon, was born in 1807, and lived to be the late emperor Napoleon III. When Napoleon distributed crowns to his relations Hortense was very anxious that her husband should receive that of Italy. Holland, however, fell to his share, and the ill-matched pair retired thither. The death of her eldest son made Holland intolerable to Hortense, and before long she returned to Paris and established herself in the Rue Cerutti. Nor did she from that time forward ever live in any regular fashion with her husband, whose forced abdication of his crown soon followed. In Paris she was more popular than respected, and her leisure time was filled up with many quasi-literary and artistic employments. It was there that she signalized herself by composing among other airs the famous melody of *Partant pour la Syrie*. The ineffable silliness of the words of this song is not due to her, but to a certain M. de Laborde; and it is only fair to say that it took Frenchmen twenty years to find out that the air was ugly, and that it was possibly stolen. Hortense continued even after her mother's divorce to exercise a certain influence over her stepfather. At the first Restoration she was confirmed in her title and possessions as Duchesse de Saint-Leu. But she ardently welcomed the returning emperor, and thenceforward France was hardly a residence for her, while her private life was disturbed by constant and indecent bickerings with her husband about the custody of her children. She bought a house at Arenenberg on the Lake of Constance and another at Augsburg, for the sake of educating her sons, and from time to time she undertook various journeys in the hope of furthering their interests. The Revolution of July gave her some chance of returning to France, but immediately afterward grave misfortunes overtook her. Her sons took part in the Italian risings, and the elder died of measles. Scarcely had she recovered from this when the Strasburg attempt was made against her advice. She lived long enough to see the future emperor return from America, and died at Arenenberg on October 3, 1837. Generally speaking, Hortense appears to have been an amiable woman whose life was spoilt by the tyrannical egotism of her stepfather. She seems, however, to have been unduly given to intrigue; and she herself admitted that she might have lived on better terms with her husband, upon whom she was forced almost as much as he was forced on her.

HORTENSIUS, QUINTUS, was one of the first and most famous orators at the Roman bar in the latter days of the republic, when the orator's art was particularly flourishing and was diligently cultivated. Hortensius, like other eminent Roman citizens, passed through the regular succession of public offices, rising from the quæstorship in 81 to the consulship in 69 B. C. In 50 B. C., the last year of his life, he defended successfully one Ap-

pius Claudius against Dolabella, Cicero's son-in-law, who prosecuted the man on a serious charge of bribery.

HORTICULTURE embraces both the art and the science of the cultivation of garden plants, whether for utilitarian or for decorative purposes. Horticulture, apart from the mechanical details connected with the maintenance of a garden and its appurtenances, may be considered as the application of the principles of vegetable physiology to the cultivation of plants.

We propose here to notice briefly the several parts of a flowering plant, and to point out the rationale of the cultural procedures connected with them.

The Root.—The root, though not precluded from access of air, is not directly dependent for its growth on the agency of light. The efficiency of drainage, digging, hoeing, and like operations is accounted for by the manner in which they promote aëration of the soil, raise its temperature, and remove its stagnant or superfluous moisture. Owing to their growth in length at, or rather in the immediate vicinity of, their tips, roots are enabled to traverse long distances by surrounding some obstacles, penetrating others, and insinuating themselves into narrow crevices. As they have no power of absorbing solid materials, their food must be of a liquid or gaseous character. It is taken up from the interstices between the particles of soil exclusively by the finest subdivisions of the fibrils, and in many cases by the extremely delicate thread-like cells which project from them, and which are known as root-hairs. The number and density of these latter are in direct proportion to the abundance and suitability of the food of the plant. The importance of the root-fibers, or "feeding roots," justifies the care which is taken by every good gardener to secure their fullest development, and to prevent as far as possible any injury to them in digging, potting, and transplanting, such operations being therefore least prejudicial at seasons when the plant is in a state of comparative rest.

Root-Pruning and Lifting.—In apparent disregard of the general rule enunciated is the practice of root-pruning fruit trees, when, from the formation of wood being more active than that of fruit, they bear badly. The contrariety is more apparent than real, as the operation consists in the removal of the coarser root, a process which results in the development of a leash of fine feeding roots. Moreover, there is a generally recognized quasi-antagonism between the vegetative and reproductive processes, so that, other things being equal, anything that checks the one helps forward the other.

Watering.—So far as practical gardening is concerned, feeding by the roots after they have been placed in suitable soil is confined principally to the administration of water, and, under certain circumstances, of liquid manure; and no operations demand more judicious management. The amount of water required, and the times when it should be applied, vary greatly according to the kind of plant and the object for which it is grown, the season, the supply of heat and light, and numerous other conditions, the influence of which is to be learned by experience only. The same may be said with respect to the application of manures. The watering of pot-plants requires especial care. Water should as a rule be used at a temperature not lower than that of the surrounding atmosphere, and preferably after exposure for some time to the air.

Bottom-Heat.—The "optimum" temperature, or that best suited to promote the general activity of roots, and, indeed, of all vegetable organs, necessarily varies very much with the nature of the plant, and the circumstances in which it is placed, and is ascertained by practical experience. Artificial heat applied to the roots, called by

gardeners "bottom-heat," is supplied by fermenting materials, dung, tan, flues, or hot-water pipes. In some cases solar heat is as it were entrapped by placing beneath the roots substances such as bricks, the heat previously absorbed by which is slowly radiated. In winter the temperature of the soil, out of doors, beyond a certain depth is usually higher than that of the atmosphere, so that the roots are in a warmer and more uniform medium than are the upper parts of the plant. Often the escape of heat from the soil is prevented by "mulching," *i.e.*, by depositing on it a thick layer of litter, straw, dead leaves, and the like.

The *Stem* and its subdivisions or branches lengthen, not only near the tip, but also lower down, by intercalary growth. They upraise to the light and air the leaves and flowers, and serve as channels for the passage to them of fluids from the roots, and they act as reservoirs for nutritive substances. Their functions in annual plants cease after the ripening of the seed, while in plants of longer duration layer after layer of strong, woody tissue is formed, which enables them to bear the strains which the weight of foliage and the exposure to wind, etc., entail. The gardener aims usually at producing stout, robust, short-jointed stems, instead of long, lanky growths defective in woody tissue. To secure these conditions free exposure to light and air is requisite, but in the case of coppice woods, or where long, straight spars are needed by the forester, plants are allowed to grow thickly so as to ensure development in an upward rather than in a lateral direction. This and like matters will, however, be more fitly considered in dealing hereafter with the buds and their treatment.

Leaves.—The work of the leaves may briefly be stated to consist in the processes of nutrition and of respiration. Nutrition by the leaves includes the inhalation of air, and the combination, under the influence of light and in the presence of chlorophyll, of carbon from the carbonic acid gas in the air with hydrogen from the watery vapor it contains, oxygen being exhaled. There is also a process of true respiration, in which atmospheric oxygen unites with a portion of the carbon in the plant, and is evolved as carbonic acid gas.

Syringing, Etc.—In certain circumstances water is absorbed by the surface of leaves, especially when the supply of moisture at the root is defective, and when by too long exposure to drought the watery constituents of the plant have evaporated. A certain amount of superfluous watery fluid or vapor is a necessary accompaniment of nutrition, but this may easily become excessive, especially where the plant cannot readily recoup itself. In these circumstances such operations as "syringing" and "damping down" are of special value. Evaporating basins or tanks in houses for orchids and other plants are beneficial for like reasons. Following Boussingault and Henslow, by whom the absorption of water by leaves has been proved, we may sum up the advantages of syringing as follows:—it washes off dust and insects from the leaves, and by moistening the cuticle promotes respiration and the absorption of water; it checks loss by transpiration, and so enables terminal shoots and young leaves to receive a sufficiency of sap from the stem; it keeps the air cool by evaporation; and lastly, as moisture is actually imbibed by the green parts of plants, it helps to compensate for any loss from within, and thus supplements root absorption.

In accordance with the facts just cited it is found that the preservation of cut flowers is promoted by inserting some of their leaves as well as their stalks in water. By cutting an herbaceous stem under water, so that the severed end is never exposed to the air, withering can to a large extent be prevented; and a bouquet may be

kept fresh for a long time either by immersing the whole in water, or by simply covering the vase of water in which it is placed with a bell-glass. In the case of "cuttings" excessive transpiration is obviated by means of bell-glasses and by shading, and sometimes by burying a portion of the cutting with a leaf attached.

Carnivorous Plants.—Before leaving the subject of nutrition by the leaves, reference may be made to the so-called carnivorous plants, *e.g.*, *Drosera*. Substances, particularly such as contain nitrogen, as insects or fragments of meat, when brought into contact with the surface of the leaves, or with certain glands on the leaves, become dissolved by the agency of a digestive ferment secreted therein, are then absorbed and serve as nutriment. (See INSECTIVOROUS PLANTS.)

Respiration, already alluded to, is not directly connected with exposure to light, since it goes on as freely by night as it does by day. It is a process requisite for the health of the plant, and contributes to maintain its heat, to perfect its structure, to eliminate some of its secretions, and to destroy effete or impure matters. Chlorophyll, according to Pringsheim, acts as a regulator of the respiration of plants by absorbing some of the luminous rays, and thereby favoring the function of assimilation.

As a result of the processes carried on in the leaves under the influence of light, many of the secretions, as starch, sugar, oils, and coloring and odoriferous matters, are formed. These either at once subserve the nutrition of the plant or are stored in its tissues, as in the case of tubers and many seeds. Usually before it can be rendered available as nourishment the stored matter has to undergo a change from a more or less insoluble to a soluble form. The changes which they undergo within the plant require very careful study, and indeed constitute a department of physiology still very greatly in need of elucidation. Pringsheim's recent researches on the action of light on chlorophyll, prosecuted with the aid of a small lens and observed under the microscope, bid fair, if confirmed, materially to change the views of chemists as to the processes which go on in leaves as a consequence of exposure to light; but, although they may change or even reverse our notions as to the mode of action of chlorophyll, they will not detract from its importance.

Buds.—The recognition of the various forms of buds, and their modes of disposition in various plants, is a matter of the first consequence in the operations of pruning and training. Flower-buds may be produced on the old wood, *i.e.*, the shoots of the past year's growth, or on a shoot of the present year. The pear and the rhododendron develop flower-buds for the next season, speedily after blossoming, and these may be stimulated into premature growth. The peculiar short stunted branches or "spurs" which bear the flower-buds of the pear, apple, and their allies, and of the laburnum, deserve special attention. In the rose, in which the flower-buds are developed at the ends of the young shoots of the year, we have an example of a plant destitute of flower-buds during the winter.

Propagation by Buds.—The detached leaf-buds (*gemme* or *bulbils*) of some plants are capable under favorable conditions of forming new plants. The edges of the leaves of *Bryophyllum calycinum* and of *Cardamine pratensis*, and the axils of the leaves of *Lilium bulbiferum* produce buds of this character. It is a matter of familiar observation that the ends of the shoots of brambles take root when bent down to the ground. In rare instances buds form on the roots, and may be used for purposes of propagation, as in the Japan quince. Of the tendency in buds to assume an

independent existence, gardeners avail themselves in the operations of striking "cuttings," and making layers and "pipings," as also in budding and grafting. In taking a slip or cutting, the gardener removes from the parent plant one or more buds or "eyes," in the case of the vine one only, attached or not to a short shoot, and places them in a moist and sufficiently warm situation, where, as previously mentioned, undue evaporation from the surface of the leaf or leaves is prevented. For some cuttings pots filled with light soil, with the protection of the propagating house and of bell-glasses, are requisite; but for many, such as willows, no such precautions are necessary, and the thrusting of the end of a shoot into moist ground suffices to insure its growth. In the case of the more delicate plants, the formation of roots is preceded by the production from the cambium of the cuttings of a succulent mass of tissue, the *callus*. It is important in some cases to retain on the cutting some of its leaves, so as to supply the requisite food for storage in the callus. In other cases, where the buds themselves contain a sufficiency of nutritive matter for the young growths, the retention of leaves is not necessary. In the tissues of willow-stakes just referred to, there exists an abundance of material available for the supply of the young roots. The most successful mode of forming roots is to place the cuttings in a mild bottom-heat, which expedites their growth, even in the case of many hardy plants whose cuttings strike roots in the open soil. With some hard-wooded trees, as the common white-thorn, roots cannot be obtained without bottom-heat. It is a general rule throughout plant culture that the activity of the roots shall be in advance of that of the leaves. Cuttings of deciduous trees and shrubs succeed best if planted early in autumn while the soil still retains the solar heat absorbed during summer. For evergreens April or May and August or September, and for greenhouse and stove plants, the spring and summer months, are the times most suitable for propagation by cuttings. The great object to be attained is to secure the formation of active roots before the approach of winter.

Layering consists simply in bending down a branch and keeping it in contact with or buried to a small depth in the soil until roots are formed; the connection with the parent plant may then be severed. Many plants can be far more easily propagated thus than by cutting.

Grafting or "*working*" consists in the transfer of a branch, the "graft" or "scion," from one plant to another, which latter is termed the "stock." The operation must be so performed that the growing tissues, or cambium-layer of the scion, may fit accurately to the corresponding layer of the stock. In *budding*, as with roses and peaches, a single bud only is implanted. *Inarching* is essentially the promotion of the union of one shoot to another of a different plant. The outer bark of each being removed, the two shoots are kept in contact by ligature until union is established, when the scion is completely severed from its original attachments. This operation is varied in detail according to the kind of plant to be propagated, but it is essential in all cases that the affinity between the two plants be near, that the union be neatly affected, and that the ratio as well as the season of growth of stock and scion be similar.

The selection of suitable stocks is a matter still requiring much scientific experiment. The object of grafting is to expedite and increase the formation of flowers and fruit. Strong-growing pears, for instance, are grafted on the quince stock in order to restrict their tendency to form "gross" shoots and a superabundance of wood in place of flowers and fruit. Apples, for the

same reason, are "worked" on the "paradise" or "douxin" stocks, which from their influence on the scion are known as dwarfing stocks. Scions from a tree which is weakly, or liable to injury by frosts, are strengthened by engrafting on robust stocks. Lindley has pointed out that, while in Persia, its native country, the peach is probably best grafted on the peach, or on its wild type the almond, in England, the summer temperature of whose soil is much lower than that of Persia, it might be expected, as experience has proved, to be most successful on stocks of the native plum.

The soil on which the stock grows is a point demanding attention. The form and especially the quality of fruit is more or less affected by the stock upon which it is grown. The effects produced by stock on scion, and more particularly by scion on stock, are, as a rule, with difficulty appreciable. Nevertheless, in exceptional cases modified growths, termed "graft-hybrids," have been obtained, which have been attributed to the commingling of the characteristics of stock and scion. Of these the most remarkable example is *Cytisus Adami*, a tree which year after year produces some shoots, foliage and flowers like those of the common laburnum, others like those of the very different looking dwarf shrub *C. purpureus*, and others again intermediate between these. We may hence infer that *C. purpureus* was grafted or budded on the common laburnum, and that the intermediate forms are the result of graft-hybridization. Numerous similar facts have been recorded. Among gardeners the general opinion is against the possibility of graft-hybridization. The wonder, however, seems to be that it does not occur more frequently, seeing that fluids must pass from stock to scion, and matter elaborated in the leaves of the scion must certainly, to some extent, enter the stock. It is clear, nevertheless, from examination, that as a rule the wood of the stock and the wood of the scion retain their external characters year by year without change. Still, as in the laburnum just mentioned, in the variegated jasmine and in *Abutilon Darwinii*, in the copper beech and in the horse-chestnut, the influence of a variegated scion has occasionally shown itself in the production from the stock of variegated shoots.

Double grafting is sufficiently explained by its name. By means of it a variety may often be propagated, or its fruit improved, in a way not found practicable under ordinary circumstances. For its successful prosecution prolonged experiments in different localities and in gardens devoted to the purpose are requisite.

Planting.—By removal from one place to another the growth of every plant receives a check. How this check can be obviated or reduced, with regard to the season, the state of atmosphere, and the condition and circumstances of the plant generally, is a matter to be considered by the practical gardener.

As to season, it is now admitted with respect to deciduous trees and shrubs that the earlier in autumn planting is performed the better; although some extend it from the period when the leaves fall to the first part of spring, before the sap begins to move. If feasible, the operation should be completed by the end of November, while the soil is still warm with the heat absorbed during summer. Attention to this rule is specially important in the case of rare and delicate plants. Early autumn planting enables wounded parts of roots to be healed over, and to form fibrils, which will be ready in spring, when it is most required, to collect food for the plant. Planting late in spring should, as far as possible, be avoided, for the buds then begin to awaken into active life, and the draft upon the roots becomes great.

The best way of performing transplantation depends

greatly on the size of the trees, the soil in which they grow, and the mechanical appliances made use of in lifting and transporting them. The smaller the tree the more successfully can it be removed. The more argillaceous and the less silicious the soil the more readily can balls of earth be retained about the roots. All planters lay great stress on the preservation of the fibrils; all, indeed, admit them to be indispensable for the absorption of nutriment. The point principally disputed is to what extent they can with safety be allowed to be cut off in transplantation. Trees and shrubs in thick plantations, or in sheltered warm places, are ill-fitted for planting in bleak and cold situations. During their removal it is important that the roots be covered, if only to prevent desiccation by the air. Damp days are therefore the best for the operation; the driest months are the most unfavorable. Though success in transplanting depends much on the humidity of the atmosphere, the most important requisite is warmth in the soil; humidity can be supplied artificially, but heat cannot.

Pruning, or the removal of superfluous growths, is practiced in order to equalize the development of the different parts of trees, or to promote it in particular directions so as to secure a certain form, and, by checking undue luxuriance, to promote enhanced fertility. In the rose-bush, for instance, in which, as we have seen, the flower-buds are formed on the new wood of the year, pruning causes the old wood to "break," *i.e.*, to put forth a number of new buds, some of which will produce flowers at their extremities. The manner and the time in which pruning should be accomplished, and its extent, vary with the plant, the objects of the operation, *i.e.*, whether for the production of timber or fruit, the season, and various other circumstances. So much judgment and experience does the operation call for that it is a truism to say that bad pruning is worse than none. The removal of weakly, sickly, overcrowded, and gross infertile shoots is usually, however, a matter about which there can be few mistakes when once the habit of growth and the form and arrangement of the buds are known. Winter pruning is effected when the tree is comparatively at rest, and is therefore less liable to "bleeding" or outpouring of sap. Summer pruning or pinching off the tips of such of the younger shoots as are not required for the extension of the tree, when not carried to too great an extent, is preferable to the coarser, more reckless style of pruning. The injury inflicted is less and not so concentrated; the wounds are smaller, and have time to heal before winter sets in. The effects of badly executed pruning, or rather hacking, are most noticeable in the case of forest trees, the mutilation of which often results in rotting, canker and other diseases. Judicious and timely thinning so as to allow the trees room to grow, and to give them sufficiency of light and air, will generally obviate the need of the pruning-saw, except to a relatively small extent.

Training is a procedure adopted when it is required to grow plants in a limited area, or in a particular shape, as in the case of many plants of trailing habit. Judicious training also may be of importance as encouraging the formation of flowers and fruit. Growth in length is mainly in a vertical direction, or at least at the ends of the shoots; and this should be encouraged, in the case of a timber tree, or of a climbing plant which it is desired should cover a wall quickly; but where flowers or fruit are specially desired, then, when the wood required is formed, the lateral shoots may often be trained more or less downward to induce fertility. The refinements of training, as of pruning, may, however, be carried too far; and not infrequently the

symmetrically trained trees of the French excite admiration in every respect save fertility.

Sports or Bud Variations.—Here we may conveniently mention certain variations from the normal condition in the size, form, or disposition of buds or shoots on a given plant. An inferior variety of pear, for instance, may suddenly produce a shoot bearing fruit of superior quality; a beech tree, without obvious cause, a shoot with finely divided foliage; or a camellia an unwontedly fine flower. When removed from the plant and treated as cuttings or grafts, such sports may be perpetuated. Many garden varieties of flowers and fruits have thus originated. The cause of their production is very obscure. In certain instances where plants have been "crossed" or hybridized, perhaps for generations, the phenomenon may be explained on the supposition of a dissociation of previously mixed elements, or of a reversion to some ancestral conditions.

Formation of Flowers.—Flowers, whether for their own sake or as the necessary precursors of the fruit and seed, are objects of the greatest concern to the gardener. As a rule they are not formed until the plant has arrived at a certain degree of vigor, or until a sufficient supply of nourishment has been stored in the tissues of the plant. The reproductive process of which the formation of the flower is the first stage being an exhaustive one, it is necessary that the plant, as gardeners say, should get "established" before it flowers. Moreover, although the green portions of the flower do indeed perform the same office as the leaves, the more highly colored and more specialized portions, which are further removed from the typical leaf-form, do not carry on those processes for which the presence of chlorophyll is essential; and the floral organs may, therefore, in a rough sense, be said to be parasitic upon the green parts. A check or arrest of growth in the vegetative organs seems to be a necessary preliminary to the development of the flower. The flower itself is always the modified extremity of a shoot or stalk, which only exceptionally lengthens beyond the flower, as for example, in "proliferous" roses.

A diminishing supply of water at the root is requisite, so as to check energy and growth, or rather to divert it from leaf-making. Partial starvation will sometimes effect this; hence the grafting of free-growing fruit-trees upon dwarfing stocks, as before alluded to, and also the "ringing" or girdling of fruit-trees, *i. e.*, the removal from the branch of a ring of bark, or the application of a tight cincture, in consequence of which the growth of the fruits above the wound or the obstruction is enhanced. On the same principle the use of small pots to confine the roots, root-pruning and lifting the roots, and exposing them to the sun, as is done in the case of the vine in some countries, are resorted to. A higher temperature, especially with deficiency of moisture, will tend to throw a plant into a flowering condition.

Forcing.—The operation of forcing is based upon the facts just mentioned. By subjecting a plant to a gradually increasing temperature, and supplying water in proportion, its growth may be accelerated; its season of development may be, as it were, anticipated; it is roused from a dormant to an active state. Forcing, therefore, demands the most careful adjustment of temperature and supplies of moisture and light.

Deficiency of light is less injurious than might at first be expected, because the plant to be forced has stored up in its tissues, and available for use, a reserve stock of material formed through the agency of light in former seasons. The intensity of the color of flowers and the richness of flavor of fruit are, however, deficient where there is feebleness of light. Recent experiments of Doctor Siemens have shown that the gardener may avail

himself of the electric light, which is proved to exercise on chlorophyll the same kind of influence as do the solar rays, and that he may thus supply the deficiencies of natural illumination. The employment of that light for forcing purposes would seem to be at present a question of expense. The great advantage hitherto obtained from its use has consisted in the rapidity with which flowers have been formed and fruits ripened under its influence, circumstances which go toward compensating for the extra cost of production.

Double Flowers.—The taste of the day demands that "double flowers" should be largely grown. Though in some instances, as in hyacinths, they are decidedly less beautiful than single ones, they always present the advantage of being less evanescent. Under the vague term of "double" many very different morphological changes are included. The flower of a double dahlia, *e. g.*, offers a totally different condition of structure from that of the rose or a hyacinth. The double poinsettia, again, owes its so-called double condition merely to the increased number of its scarlet involucre leaves, which are not parts of the flower at all. It is reasonable, therefore, to infer that the causes leading to the production of double flowers are varied. A good deal of difference of opinion exists as to whether they are the result of arrested growth or of exuberant development, and accordingly whether restricted food or abundant supplies of nourishment are the more necessary for their production. It must suffice here to say that double flowers are most commonly the result of the substitution of brightly-colored petals for stamens or pistils, or both, and that a perfectly double flower where all the stamens and pistils are thus metamorphosed is necessarily barren. Such a plant must needs be propagated by cuttings. It rarely happens, however, that the change is quite complete throughout the flower, and so a few seeds may be formed, some of which may be expected to reproduce the double-blossomed plants. By continuous selection of seeds from the best varieties, and "roguing" or eliminating plants of the ordinary type, a "strain" or race of double flowers is gradually produced.

Formation of Seed—Fertilization.—In fertilization—the influence in flowering plants of the sperm-cell, or its contents upon the germ-cell—there are many circumstances of importance horticulturally, to which, therefore, brief reference must be made. Flowers, generally speaking, are either self-fertilized, cross-fertilized or hybridized. Self-fertilization occurs when the pollen of a given flower affects the germ-cell of the same individual flower. Such a flower is hermaphrodite functionally as well as structurally. In self-fertilizing flowers the structure is such that the pollen inevitably comes in contact with the stigma; but fertilization is also dependent on the simultaneous maturity of pollen and stigma. Cross-fertilization varies both in manner and degree. In the simplest instances the pollen of one flower fertilizes the ovules of another on the same plant, owing to the stamens arriving at maturity in any one flower earlier or later than the pistils. Such flowers, though structurally hermaphrodite, are, at any given time, functionally unisexual. In many plants a polymorphic condition occurs; thus, in the same species of primrose some flowers have the stamens short, and within the tube of the corolla, with the style projecting beyond the mouth, giving the appearance termed "pin-eyed," while others, known as "thrum-eyed" present exactly reverse conditions of stamens and style. In the common loosestrife, *Lythrum Salicaria*, the stamens are of three lengths and the styles differ correspondingly. In such di- or tri-morphic flowers, as Mr. Darwin's experiments have shown, the most complete fertility occurs

when a cross is effected between a flower having short stamens and one with short styles. It is asserted that, not only is such a union more fertile than when pollen from a short stamen is placed on a long style, or *vice versa*, but the seedling plants are as a rule more vigorous.

Cross-fertilization must of necessity occur when the flowers are structurally unisexual, as in the hazel, in which the male or female flowers are monœcious, or separate on the same plant, and in the willow, in which they are diœcious, or on different plants. A conspicuous example of a diœcious plant is the common aucuba, of which for years only the female plant was known in Britain. When, through the introduction of the male plant from Japan, its fertilization was rendered possible, ripe berries, before unknown, became common ornaments of the shrub.

The conveyance of pollen from one flower to another in cross-fertilization is effected naturally by the wind, or by the agency of insects and other creatures. Flowers that require the aid of insects usually offer some attraction to their visitors in the shape of bright color, fragrance, or sweet juices. The color and markings of a flower often serve to guide the insects to the honey, in the obtaining of which they are compelled either to remove or to deposit pollen. The reciprocal adaptations of insects and flowers demand attentive observation on the part of the gardener concerned with the growing of grapes, cucumbers, melons, and strawberries, or with the raising of new and improved varieties of plants. Scarcely less remarkable, though not so important in the present connection, are the means by which the visits of such insects as are useless for the purpose of fertilization, or even injurious to the plant, as preying without advantage to it on its secretions, are prevented or rendered ineffective. In wind-fertilized plants the flowers are comparatively inconspicuous and devoid of much attractions for insects; and their pollen-cells are smoother and smaller, and better adapted for transport by the wind, than those of insect-fertilized plants, the roughness of which adapts them for attachment to the bodies of insects.

Although the general facts with respect to fertilization are as above stated, it must be remembered that probably self-fertilization is not constant in any plant under all circumstances, and that it certainly does sometimes take place in flowers which are usually cross-fertilized. It may be that, while continued self-fertilization ensures the perpetuation of certain qualities, cross-fertilization induces beneficial variation. Some botanists doubt the injurious effects attributed to self-fertilization, and, so long as a plant is healthy, it can be attended with but little disadvantage; but after a time in any case a cross is probably useful, and sometimes fertility is found to be much greater, and, in rare instances, only possible, when impregnation is effected by pollen not produced by a flower's own stamens.

It is very probable that the same flower at certain times and seasons is self-fertilizing, and at others not so. The defects which cause gardeners to speak of certain vines as "shy setters," and of certain strawberries as "blind," may be due either to unsuitable conditions of external temperature, or to the non-accomplishment, from some cause or other, of cross-fertilization. In a vinery or a peach-house it is often good practice at the time of flowering to tap the branches sharply with a stick so as to ensure the dispersal of the pollen. Sometimes more delicate and direct manipulation is required, and the gardener has himself to convey the pollen from one flower to another, for which purpose a small camel's-hair pencil is generally suitable. The degree of fertility varies greatly according to external conditions, the

structural and functional arrangements just alluded to and other causes which may roughly be called constitutional. Thus, it often happens that an apparently very slight change in climate alters the degree of fertility. Certain plants which seem almost sterile with their own pollen become fertile if grafted on some others. In a particular country or at certain seasons one flower will be self-sterile or nearly so, and another just the opposite. The influence of conditions on the formation of "races," and the consequent importance to the horticulturist seeking to obtain new and improved strains of crossing-plants grown in different localities, have been specially insisted on by Darwin. The advantages of this practice are analogous to those accruing from what gardeners call "change of seed," *i. e.*, the sowing of seed or the planting of tubers, say of potatoes, in localities and on soils other than those in which they themselves were produced.

Hybridization.—Some of the most interesting results and many of the gardener's greatest triumphs have been obtained by hybridization, *i. e.*, the crossing of two individuals, not of the same, but of two distinct species of plants, as, for instance, two species of rhododendron or two species of orchid. It is obvious that hybridization differs more in degree than in kind from cross-fertilization. The occurrence of hybrids in nature explains the difficulty experienced by botanists in deciding on what is a species, and the widely different limitations of the term adopted by different observers in the case of willows, roses, brambles, etc. The artificial process is practically the same in hybridization as in cross-fertilization, but usually requires more care. To prevent self-fertilization, or the access of insects, it is advisable to remove the stamens and even the corolla from the flower to be impregnated, as its own pollen or that of a flower of the same species is often found to be "prepotent." There are, however, cases, *e. g.*, some passion-flowers and rhododendrons, in which a flower is more or less sterile with its own, but fertile with foreign pollen, even when this is from a distinct species. It is a singular circumstance that reciprocal crosses are not always or even often possible; thus, one rhododendron may afford pollen perfectly potent on the stigma of another kind, by the pollen of which latter its own stigma is unaffected. With respect to the relations of the hybrid offspring, which partakes, sometimes more of the characteristics of the male or pollen parent, sometimes more of those of the female or seed parent, the opinions of practical experimenters are so diverse that at present no general rule can be established.

The object of the hybridizer is to obtain varieties exhibiting improvements in hardihood, vigor, size, shape, color, fruitfulness, or other attributes. His success depends not alone on skill and judgment for some seasons, or days even, are found more propitious than others. Although promiscuous and hap-hazard procedures no doubt meet with a measure of success, the best results are those which are attained by systematic work with a definite aim.

Hybrids are usually less fertile than pure-bred species, and are occasionally quite sterile. Some hybrids, however, are as fertile as pure-bred plants. Hybrid plants may be again crossed, or even re-hybridized, so as to produce a progeny of very mixed parentage. This is the case with many of our roses, dahlias, begonias, pelargoniums, and other long or widely cultivated garden plants.

Reversion.—In modified forms of plants there is frequently a tendency to "sport" or revert to parental or ancestral characteristics. So markedly is this the case with hybrids that in a few generations all traces of a hybrid origin may disappear. The dissociation of the

hybrid element in a plant must be obviated by careful selection.

Germination.—The length of the period during which seeds remain dormant after their formation is very variable. The conditions for germinating are much the same as for growth in general. Access to light is not required, because the seed contains a sufficiency of stored-up food. The temperature necessary varies according to the nature and source of the seed. Some seeds require prolonged immersion in water to soften their shells; others are of so delicate a texture that they would dry up and perish if not kept constantly in a moist atmosphere. Seeds buried too deeply receive a deficient supply of air. As a rule, seeds require to be sown more deeply in proportion to their size and the lightness of the soil.

The time required for germination in the most favorable circumstances varies very greatly, even in the same species, and in seeds taken from one pod. Thus the seeds of *Primula japonica*, though sown under precisely similar conditions, yet come up at very irregular intervals of time. Germination is often slower where there is a store of available food in the perisperm or albumen, or in the embryo itself, than where this is scanty or wanting. In the latter case the seedling has early to shift for itself, and to form roots and leaves for the supply of its needs.

Selection.—Supposing seedlings to have been developed, it is found that a large number of them present considerable variations, some being especially robust, others peculiar in size or form. Those most suitable for the purpose of the gardener are carefully selected for propagation, while others not so desirable are destroyed; and thus after a few generations a fixed variety, race, or strain superior to the original form is obtained. Many garden plants have originated solely by selection; and it is certain that, quite independently of cross-breeding, much could still be done to improve our breeds of vegetables, flowers, and fruits by more systematic selection.

Large and well-formed seeds are to be preferred for harvesting. The seeds should be kept in sacks or bags in a dry place, and if from plants which are rare, or liable to lose their vitality, they are advantageously packed for transmission to a distance in bottles or jars filled with earth or sphagnum moss, without the addition of moisture. Cuttings and entire plants may be transported in wide-mouthed bottles.

It will have been gathered from what has been said that seeds cannot always be depended on to reproduce exactly the characteristics of the plant which yielded them; for instance, seeds of the greengage plum or of the Ribston pippin will produce a plum or an apple, but not these particular varieties, to perpetuate which grafts or buds must be employed.

THE PRACTICE OF HORTICULTURE.

The details of horticultural practice range under the three heads of flowers, fruits and vegetables. There are, however, certain general aspects of the subject which will be more conveniently noticed apart, since they apply alike to each department. We shall, therefore, first treat of these under four headings:—formation and preparation of the garden, garden structures and edifices, garden materials and appliances, and garden operations.

I. Formation and Preparation of the Garden.

1. *Site.*—Ground possessing a gentle inclination toward the south is desirable for a garden. On such a slope effectual draining is easily accomplished, and the greatest possible benefit is derived from the sun's rays. It is well also to have an open exposure toward the east

and west, so that the garden may enjoy the full benefit of morning and evening sun, especially the latter; but shelter is desirable on the north and northeast, or in any direction in which the particular locality may happen to be exposed.

2. *Soil and Subsoil.*—A hazel-colored loam, moderately light in texture, is well adapted for most garden crops, whether of fruits or culinary vegetables, especially a good warm deep loam resting upon chalk; and if such a soil occurs naturally in the selected site, but little will be required in the way of preparation. If the soil is not moderately good and of fair depth, the situation is not an eligible one for gardening purposes. Wherever the soil is not quite suitable, but is capable of being made so, it is best to remedy the defect at the outset; and as it will be found easier to render a light soil sufficiently retentive than to make a tenacious clay sufficiently porous, a light soil is to be preferred to one which is excessively stiff and heavy. It is advantageous to possess a variety of soils; and if the gardens be on a slope, it will often be practicable to render the upper part light and dry, while the lower remains of a heavier and damper nature.

3. *Shelter.*—A screen of some kind to temper the fury of the blast is absolutely necessary. If the situation is not naturally well sheltered, the defect may be remedied by masses of forest trees disposed at a considerable distance so as not to shade the walls or fruit trees. They should not be nearer than, say, fifty yards, and may vary from that to 100 or 150 yards distance according to circumstances, regard being had especially to peculiarities occasioned by the configuration of the country, as for instance to ærial currents from adjacent eminences. Care should be taken, however, not to hem in the garden by crowded plantations, shelter from the prevailing strong winds being all that is required, while the more open it is in other directions the better.

4. *Water Supply.*—Although water is one of the most important elements in vegetable life, we do not find one garden in twenty where even ordinary precautions have been taken to secure a competent supply. Rain-water is the best, next to that river or pond water, and last of all that from springs. Iron pipes are the best conductors; they should lead to a capacious open reservoir placed outside the garden, and at the highest convenient level in order to secure sufficient pressure for effective distribution, and so that the wall trees also may be effectually washed. Standpipes should be placed at intervals beside the walks and in other convenient places from which water may at all times be drawn; and short flexible tubes should be made to fit onto them, to which a garden hose can be attached, so as to permit of the whole garden being readily and when necessary profusely watered.

5. *Walks and Edgings.*—The best material for the construction of garden walks is good binding gravel. The ground should be excavated to the depth of a foot or more—the bottom being made firm and slightly concave, so that it may slope to the center, where a drain should be introduced; or the bottom may be made convex and the water allowed to drain away at the sides. The bottom nine inches should be filled in compactly with hard, coarse materials, such as stones, brickbats, clinkers, burned clay, etc., on which should be laid two or three inches of coarse gravel, and then an inch or two of firm binding gravel on the surface. The surface of the walks should be kept well rolled, for nothing contributes more to their elegance and durability.

II. Garden Structures.

6. *Walls.*—The shelter afforded by a wall, and the increased temperature secured by its presence, are indispensable in some climates for the production of all the

finer kinds of outdoor fruits; and hence the inner side of a north wall, having a southern aspect, is appropriated to the more tender kinds. It is, indeed, estimated that such positions enjoy an increased temperature equal to 7° of latitude; that is to say, the mean temperature within a few inches of the wall is equal to the mean temperature of the open plain 7° farther south. The eastern and western aspects are set apart for fruits of a somewhat harder character.

7. *Espalier Rails*.—Subsidiary to walls as a means of training fruit-trees, espalier rails were formerly much employed, and are still used in many gardens. In their simplest form, they are merely a row of slender stakes of larch or other wood driven into the ground, and connected by a slight rod or fillet at top. The use of iron rails has now been almost wholly discontinued on account of metallic substances acting as powerful conductors of both heat and cold in equal extremes. Trees trained to espalier rails have some advantages, as they are easily got at for cultural operations, space is saved, and the fruit, while freely exposed to sun and air, is tolerably secure against wind. They form, moreover, neat enclosures for the vegetable quarters, and provided excess of growth from the center is successfully grappled with, they are productive in soils and situations which are suitable.

8. *Plant Houses*.—These include all those structures which are more intimately associated with the growth of ornamental plants and flowers, and comprise conservatory, plant stove, greenhouse, and the subsidiary pits and frames. They should be so erected as to present the smallest extent of opaque surface consistent with stability. With this object in view, the early improvers of hothouse architecture substituted metal for wood in the construction of the roofs, and for the most part dispensed with back walls; but the conducting power of the metal caused a great irregularity of temperature, which it was found difficult to control; and, notwithstanding the elegance of metallic houses, this circumstance, together with their greater cost, and some doubt as to their durability, has induced most recent authorities to give the preference to wood. The combination of the two, however, shows clearly that without much variation of heat or loss of light, any extent of space may be covered, and houses of any altitude constructed.

Plant houses should be constructed of the best pine timber, as being the most durable, but the whole of the parts should be kept as light as possible. In many houses, especially those where ornament is of no consequence, the rafters are now omitted, or only used at wide intervals, somewhat stouter sash-bars being adopted, and stout panes of glass, 8 to 12 inches wide, made use of. Such houses are very light; being also very close, they require careful ventilation.

9. *Pits and Frames*.—These are used both for the summer growth and winter protection of various kinds of ornamental plants, for the growth of such fruits as cucumbers, melons, and strawberries, and for the forcing of vegetables. When heat is required, it is sometimes supplied by means of fermenting dung, or dung and leaves, or tanner's bark, but it is much more economically provided, on the score of labor at least, by hot-water pipes.

10. *Mushroom House*.—Mushrooms may be grown in sheds and cellars, or even in protected ridges in the open ground, but a special structure is usually devoted to them. A lean-to against the north side of the garden wall will be found suitable for the purpose, though a span-roofed form may also be adopted, especially if the buildings stand apart.

11. *Heating Apparatus*.—Plant houses are heated in a variety of ways, but practically smoke flues and hot-water pipes are principally made use of. The cost of erection is a little more for hot-water pipes than the flues, but the former are the cheaper in the end. Steam is not now used as a heating medium, except where the waste steam of a manufactory is turned to account in some adjoining garden. The use of fermenting vegetable substances in the production of heat is rapidly disappearing from our best gardens before the application of hot water, which is far more economical and certain in its effects.

12. *Ventilating Apparatus*.—The object of ventilation is not so much to aid the respiration of the plants as to carry off noxious vapors and to regulate the moisture and temperature. The mechanical agitation both of the atmosphere and of the foliage caused by a free circulation, provided it be not too cold or too rudely admitted, has also a beneficial influence on the health of the plants.

The mode of ventilating plant houses formerly in use was by letting down the top roof sashes; this was often supplemented by having the front or upright sashes also made movable, and more or less widely opened either outward or laterally during the daytime. It is much more economical, however, and equally efficacious, to have the roof sashes fixed, and the top ventilation effected by means of a lantern in the case of a span-roofed house, or by horizontal ventilators near the top of the back wall in a lean-to. The front ventilation may be effected by openings in the front wall opposite the heating pipes, by which means the cold air is warmed, which is the best plan in all houses where a high temperature has to be maintained, and is especially necessary in forcing-houses, on account of the risk of injury to the foliage from cold air; or the front sashes may be made movable, which is better in temperate houses. In the case of pits, where there are no front sashes provided, the ventilators are sufficient for the purpose. The sliding down of one sash over the other, as once generally and even now frequently practiced, generally augments the shade in oblique sunshine, and is strongly objectionable on that account. The lantern mode of construction obviates this, but in a lean to, and even with span roofs, it is better to have shorter movable sashes, hung so as to open by being elevated at a lower edge instead of sliding one over the other. A very slight elevation is sufficient for the egress of vitiated air.

13. *Hygrometry*.—For the healthy growth of plants, the regulation of the moisture is as necessary as the regulation of the heat. A considerable degree of moisture is necessary in the cases of most plants cultivated in a high temperature; but the amount varies, of course; in different cases, and this presents one of the principal difficulties in the management of what is called a mixed collection, whether of stove or greenhouse plants. In the case of fruits, where a house is mostly devoted to one subject, whether grapes, peaches, pines or melons, the requisite conditions can be more readily secured. The instrument with which the amount of moisture present in the atmosphere is measured is the hygrometer. The two hygrometers most generally used are Daniell's and the dry and wet bulb, the former a more delicate instrument, best adapted for scientific observations, the latter a simpler instrument better adapted for horticultural purposes, because requiring less delicate manipulation. It consists of two thermometers mounted on one frame, the readings of which when uncovered should correspond. One bulb is left uncovered, the other is covered with muslin, and a few threads of cotton, with their other

ends immersed in water, keep it constantly moist. The temperature is lowered by the evaporation from the moistened bulb, and the difference in the readings of the two thermometers shows the degree of dryness.

III. Garden Materials and Appliances.

14. *Soils and Composts.*—The principal soils used on gardens, either alone, or mixed to form what are called composts, are — loam, sand, peat, leaf-mold, and mixtures and combinations of these made up to suit the different subjects under cultivation.

Loam is the staple soil for the gardener; it is not only used extensively in the pure and simple state, but enters into most of the composts prepared specially for his plants. For garden purposes loam should be rather unctuous or soapy to the touch when moderately dry, not clinging nor adhesive, and should readily crumble when a compressed handful is thrown on the ground. If it clings together closely it is too heavy and requires amelioration by the admixture of gritty material; if it has no cohesion when squeezed tightly in the hand, it is too light, and needs to be improved by the addition of heavier or clayey material. Sound friable loam, cut one sod deep from the surface of a pasture, and stacked up for twelve months in a heap or ridge, is invaluable to the gardener. When employed for making vine borders, loam of a somewhat heavier nature can be used with advantage, on account of the porous materials which should accompany it. For stone fruits a calcareous loam is best; indeed, for these subjects a rich calcareous loam used in a pure and simple state cannot be surpassed. Somewhat heavy loams are best for melons and strawberries, and may be used with the addition of manures only; but for ornamental plants a loam of somewhat freer texture is preferable and more pleasant to work. Loam which contains much red matter (iron) should be avoided.

Sand is by itself of little value except for striking cuttings, for which purpose fine, clean, sharp silver sand is the best; and a somewhat coarser sand, if it is gritty, is to be preferred to the comminuted sands which contain a large proportion of earthy matter. River sand and the sharp grit washed up sometimes by the roadside are excellent materials for laying around choice bulbs at planting time to prevent contact with earth which is perhaps manure-tainted. Sea sand may be advantageously used both for propagating purposes and for mixing in composts, in order to give them the needful porosity to carry off all excess of moisture from the roots. If the finer earthy sands only are obtainable, they must be rendered sharper by washing away the earthy particles. Washed sand is best for all plants like heaths, which need a pure and lasting compost.

Peat soil is largely employed in the culture of rhododendrons, azaleas, heaths, etc. In districts where heather and gritty soil predominate, the peat soil is poor and unprofitable, but selections from both the heathy and the richer peat soils, collected with judgment, and stored in a dry part of the compost yard, are essential ingredients in the cultivation of many choice pot plants, such as the Cape heaths, and many of the Australian plants. Most monocotyledons do well in peat, even if they do not absolutely require it.

Leaf-mold is eminently suited for the growth of many free-growing plants, especially when it has been mixed with stable manure, and has been subjected to fermentation for the formation of hot-beds. In any state most plants feed greedily upon it, and when pure or free from decaying wood or sticks, it is a very safe ingredient in composts; but it is so liable to generate fungus, and the mycelium or spawn of certain fungi is so injurious to the roots of trees, attacking them if at

all sickly or weakened by drought, that many cultivators prefer not to mix leaf-mold with the soil used for permanent plants, as peaches or choice ornamental trees. For quick-growing plants, however, as for example most annuals cultivated in pots, such as balsams, cockscombs, globe-amaranths, and the like, for cucumbers, and for young soft-wooded plants generally, it is exceedingly useful, both by preventing the consolidation of the soil and as a manure. The accumulations of light earth formed on the surface in woods where the leaves fall and decay annually are leaf-mold of the finest quality.

Composts are mixtures of the foregoing ingredients in varying proportions and in combination with manures if necessary, so as to suit particular plants or classes of plants. The chief point to be borne in mind in making these mixtures is not to combine in the same compost any bodies that are antagonistic in their nature, as for example lime and ammonia. In making up composts for pot plants, the fibrous portion should not be removed by sifting, except for small-sized pots, but the turfy portions should be broken up by hand and distributed in larger or smaller lumps throughout the mass. When sifting is had recourse to, the fibrous matter should be rubbed through the meshes of the sieve along with the earthy particles. Before being used the turfy ingredients of composts should lie together in a heap only long enough for the roots of the herbage to die, not to decompose.

15. *Manures.*—These are of two classes, organic and inorganic—the former being of animal and vegetable, the latter of mineral origin.

Farm-yard manure consists of the mixed dung of horses and cattle thrown together and more or less soaked with liquid drainings of the stable or byre. It is no doubt the finest stimulant for the growth of plants, and that most adapted to restore the fertile elements which the plants have abstracted from exhausted soils. This manure is best fitted for garden use when in a moderately fermented state.

Horse dung is generally the principal ingredient in all hot-bed manure; and in its partially decomposed state, as afforded by exhausted hot-beds, it is well adapted for garden use. It is most beneficial on cold stiff soils. It should not be allowed to lie too long unmoved when fresh, as it will then heat violently, and the ammonia is thus driven off. To avoid this, it should be turned over two or three times, if practicable, and well moistened—preferably with farm-yard drainings.

Cow dung is less fertilizing than horse dung, but being slower in its action it is more durable; it is also cooler, and therefore better for hot dry soils. Thoroughly decayed, it is one of the best of all manures for mixing in composts for florist's flowers and other choice plants.

Pig dung is very powerful, containing more nitrogen than horse dung; it is therefore desirable that it should undergo moderate fermentation, which will be secured by mixing it with litter and a portion of earth. When weeds are thrown to the pigs this fermentation becomes specially desirable to kill their seeds. The drainings of a pig-stye form a most valuable liquid manure for vegetable crops.

Night-soil is an excellent manure for all bulky crops, but requires to be mixed with earth or peat, or coal-ashes, so as both to deodorize it and to ensure its being equally distributed. Quick lime should not be used, as it dispels the greater part of the ammonia. When prepared by drying and mixing with various substances, night-soil is sold as poudrette, or desiccated night-soil, the value of which depends upon the materials used for admixture.

Malt-dust is an active manure frequently used as a top-dressing, especially for fruit-trees in pots. It is rapid in its action, but its effects are not very permanent. *Rape dust* is somewhat similar in its character and action.

Bones are employed as a manure with decided advantage both to vegetable crops and to fruit trees, as well as to flowers. For turnips bone manure is invaluable. The effects of bones are no doubt mainly due to the phosphates they contain, and they are most effectual on dry soils. They are most quickly available when dissolved in sulphuric acid.

17. *Guano*.—Peruvian guano was at one time imported from the Chincha Islands in enormous quantities; but the old deposits are practically exhausted, and the quality of the now available supply is comparatively poor. Ichaboe (off southwest Africa) guano is still imported, though in somewhat limited quantity; but it is much the richest available guano. The value of these guanos lies in the percentages of nitrogenous organic matter, ammonia salts, phosphates of the alkalies and of lime, and the potash salts which they contain. Some of the Islands in the South Pacific yield supplies of guano, but these are almost purely phosphatic, owing to the abundant rainfall of that region having washed out all the ammoniacal salts. Liebig's Guano and Liebig's Meat Meal are by-products from the preparation of Liebig's extract of meat. They are in a fine state of mechanical division, and are valuable sources of nitrogen and phosphates. Fish-guano is largely produced in Norway and the north of Scotland from fish offal. The process employed is essentially steaming to remove the oil, which is run off with the water; the solid residue is pressed and dried. The manurial constituents of this material are nitrogen and phosphates.

Dried Blood is another valuable source of nitrogen. Horn powder, shoddy and wool waste, leather raspings, etc., are also employed for the same purpose, but they are of much less value.

Pigeon-dung approaches guano in its power as manure. It should be laid up in ridges of good loamy soil in alternate layers to form a compost, which becomes a valuable stimulant for any very choice subjects if cautiously used. The dung of the domestic fowl is very similar in character.

Horn, hoof-parings, woolen rags, fish blubber and blood are all good manures and should be utilized if readily obtainable. *Sawdust* and *tan* are of less value.

Liquid manure, consisting of the drainings of dung-heaps, stables, cowsheds, etc., or of urine collected from dwelling houses or other sources, is a most valuable and powerful stimulant, and can be readily applied to the roots of growing plants. The urine should be allowed to putrefy, as in its decomposition a large amount of ammonia is formed, which should then be fixed by sulphuric acid or gypsum; or it may be applied to the growing crops after being freely diluted with water or absorbed in a compost heap. Liquid manures can be readily made from most of the solid manures when required, simply by admixture with water. When thus artificially compounded, unless for immediate use, they should be made strong for convenience of storage, and applied as required much diluted.

18. *Phosphatic Substances*.—The coprolites of Cambridge, Norfolk, and Suffolk come under this classification, as does also the land phosphate from the Ashley Basin of South Carolina, and the dredged phosphate from the Ashley and Cooper rivers. In addition to these we have Canadian apatite, Sombrero, Navassa, Somme, Belgian, Florida, Spanish, Curacao,

and numerous other phosphates. These are of little value as manure in their natural and ground state, and are almost wholly converted into super-phosphate by the action of sulphuric acid, whereby the natural or tricalcic phosphate—which is insoluble in water—is converted into the monocalcic phosphate, which is soluble, and therefore readily available to plants.

Ammonia is the most powerful of the manures of the inorganic series, and one of the most important of the constituents of manures generally, since it is the chief source whence plants derive their nitrogen. It is largely supplied in all the most fertilizing of organic manures, but when required in the inorganic state must be obtained from some of the salts of ammonia, as the sulphate, the muriate, or the phosphate, all of which, being extremely energetic, require to be used with great caution. These salts of ammonia may be used at the rate of from two to three cwt. per acre as a top-dressing in moist weather. When dissolved in water they form active liquid manures.

19. *Sulphate of Ammonia* is principally derived from the destructive distillation of coal and shale. Its value depends upon the percentage of ammonia which it contains. This salt sometimes contains sulphocyanide of ammonium, a substance which is inimical to plant-life. Some experimentalists assert with all confidence that ammonia salts must undergrow nitrification before they can enter the plant; but that contention is scarcely now tenable, because nitrification is possible in some cases within the plant itself.

Nitrate of Soda or *Chili Saltpetre* is very extensively imported, and is sold on a basis of 95 per cent. nitrate, or "5 per cent. refraction"—i. e., not more than 5 per cent. of impurities. It is found native in several districts of South America in an impure state, and is rendered marketable by a process of solution and recrystallizing. Its action as a manure is comparable to that of nitrate of lime, nitrate of potash, or sulphate of ammonia. Its only valuable constituent is nitric acid, while in the other nitrates mentioned the base is also serviceable.

Potash and *soda* are also valuable inorganic manures in the form of carbonates, sulphate, silicates, and phosphates, but the most extensively employed is the nitrate of potash.

Lime in the caustic state is beneficially applied to soils which contain an excess of inert vegetable matter and hence may be used for the improvement of old garden soils saturated with humus.

Gypsum, or sulphate of lime, applied as a top-dressing at the rate of two to three cwt. per acre, has been found to yield good results, especially on light soils. It is also employed in the case of liquid manures to fix the ammonia.

Burnt clay has a very beneficial effect on clay land by improving its texture and rendering soluble the alkaline substances it contains.

Vegetable refuse of all kinds, when smother-burned in a similar way, becomes a valuable mechanical improver of the soil; but the preferable course is to decompose it in a heap with quicklime and layers of earth, converting it into leaf-mold.

Soot forms a good top-dressing; it consists principally of charcoal, but contains ammonia, whence its value as a manure is derived. It should be kept dry until required for use. It may also be used beneficially in preventing the attacks of insects, such as the onion gnat and turnip fly, by dusting the plants or dressing the ground with it.

Common salt acts as a manure when used in moderate quantities, but in strong doses is injurious to vegetation.

20. *Tools, Implements, etc.*—With regard to garden tools, instruments, implements and machinery, it is only some of the more modern inventions and improvements, that can be touched on here. The two indispensable tools are the spade and the knife. The spade is commonly used for digging and trenching. The pitchfork or hoe is a very useful tool for breaking up the surface soil, the three-pronged end being used for the looser parts, and the mattock end for breaking clods, or when the surface has become much consolidated. The drag is also useful—a light, three-pronged tool, which may be used for loosening the soil among vegetable crops as well as flower garden plants, and may also be sometimes employed, if the tines are sufficiently narrow and pointed, to drag off weeds from the surface. The hand-fork, a short-handled, three-tined implement, is extremely handy for many purposes, such as loosening weeds for hand-weeding, or for planting or transplanting small subjects; it is also very handy for plunging pots, either indoors or out, in tan-beds, ash-beds, or common soil. Hoes and rakes made with tapered neck and socket, into which the handle is fitted, do not clog so readily as when they are driven into a ferruled handle.

For pruning purposes a variety of instruments have been invented, under the names of sécateurs, pruning-shears, pruning-scissors, etc., but nothing equals a well-tempered, old-fashioned knife, varied in form, strength, and size to suit the particular object to be operated on.

For the destruction of insects fumigators are useful, but an equally efficient plan is to put a few live embers in a flower pot, raised on two bricks so placed as not to close the hole at the bottom; on these embers moistened tobacco or tobacco paper is to be put, and over all damped moss. This will burn slowly and fill the house with smoke, care being taken that the material, as it dries, is lightly sprinkled with water, so that it does not burn into a flame.

Sulphurators are instruments for distributing flowers of sulphur, for the purpose of destroying mildew. In the case of greenhouse plants, such as heaths, simply dusting with sulphur through a muslin bag or dredger is sufficient; but in cases where vines are attacked with the *Oidium* or vine-mildew, the saving of the crop depends on the prompt diffusion of sulphur over all the affected parts, and this could not be so readily done by any other contrivance as by some one of the various forms of sulphurator.

For the distribution of water in the form of spray, syringes are used.

IV. Garden Operations.

21. *Propagation.*—The increase of plants, so far as the production of new individuals of particular kinds is concerned, is one of the most important and constantly recurring of gardening operations. In effecting this, various processes are adopted, which will now be described.

(1) *By Seeds.*—This may be called the natural means of increasing the number of any particular kind of plant, but it is to be remembered that we do not by that means secure an exact reproduction of the parent. We may get a progeny very closely resembling it, yet each plant possessing a distinct individuality of its own; or we may get a progeny very unlike the parent, or a mixed progeny showing various degrees of divergence. Many seeds will grow freely if sown in a partially ripened state; but, as a general rule, seeds have to be kept for some weeks or months in store, and hence they should be thoroughly ripened before being gathered. They should be sown in fine, rich soil, and such as will not readily get consolidated. In the case of outdoor crops, if the soil is inclined to be heavy, it is a good plan to cover all the smaller seeds

with a light compost. Very small seeds should only have a sprinkling of light earth or of sand, and sometimes only a thin layer of soft moss to exclude light and preserve an equable degree of moisture. Somewhat larger seeds sown indoors may be covered to the depth of one-eighth or one-fourth of an inch, according to their size. Outdoor crops require to be sown, the smaller seeds from half an inch to an inch, and the larger ones from two to four inches under the surface, the covering of the smaller ones especially being light and open. Many seeds grow well when raked in; that is, the surface on which they are scattered is raked backward and forward until most of them are covered. Whatever the seeds, the ground should be made tolerably firm both beneath and above them; this may be done by treading in the case of most garden crops, which are also better sown in drills, this admitting the more readily of the ground being kept clear from weeds by hoeing. All seeds require a certain degree of heat to induce germination. For tropical plants the heat of a propagating house—75° to 80°, with a bottom heat of 80° to 90°—is desirable, and in many cases absolutely necessary; for others, such as half-hardy annuals, a mild hotbed, or a temperate pit ranging from 60° to 70°, is convenient; while, of course, all outdoor crops have to submit to the natural temperature of the season. It is very important that seeds should be sown when the ground is in a good working condition, and not clammy with moisture.

(2) *By Offsets.*—This mode of increase applies specially to bulbous plants, such as the lily and hyacinth, which produce little bulbs on the exterior round their base. Most bulbs do so naturally to a limited but variable extent; when more rapid increase is wanted the heart is destroyed, and this induces the formation of a larger number of offsets. The stem bulbs of lilies are similar in character to the offsets from the parent bulb. The same mode of increase occurs in the gladiolus and crocus, but their bulb-like permanent parts are called corms, not bulbs. After they have ripened in connection with the parent bulb, the offsets are taken off, stored in appropriate places, and at the proper season planted out in nursery beds.

(3) *By Tubers.*—The tuber is a fleshy underground stem, furnished with eyes which are either visible, as in the potato and in some familiar kinds of *Tropæolum* (*T. tuberosum*) and of *Oxalis* (*O. crenata*), or latent, as in the Chinese yam (*Dioscorea Batatas*). When used for propagation, the tubers are cut up into what are called “sets,” every portion having an eye attached being capable of forming an independent plant. The cut portions of bulky sets should be suffered to lie a short time before being planted, in order to dry the surface and prevent rotting; this should not, however, be done with such tropical subjects as caladiums, the tubers of which are often cut up into very small fragments for propagation, and of course require to be manipulated in a properly heated propagating pit. No eyes are visible in the Chinese yam, but slices of the long club-shaped tubers will push out young shoots and form independent plants, if planted with ordinary care.

(4) *By Division.*—Division, or partition, is usually resorted to in the case of tufted growing plants, chiefly perennial herbs; they may be evergreen, as chamomile or thrift, or when dormant may consist only of underground crowns, as larkspur or lily of the valley; but in either case the old tufted plant, being dug up, may be divided into separate pieces, each furnished with roots, and, when replanted, generally starting on its own account, without much check. Suffruticose plants and even small shrubs may be propagated in this way, by first planting them deeper than they are ordinarily grown, and then after the lapse of a year, which time

they require to get rooted, taking them up again and dividing them into parts or separate plants. Box-edging and southernwood are examples. The same ends may sometimes be effected by merely working fine soil in among the base of the stems, and giving them time to throw out roots before parting them.

(5) *By Suckers*.—Root suckers are young shoots from the roots of plants, chiefly woody plants, as may often be seen in the case of the elm and the plum. The shoots when used for propagation must be transplanted with all the roots attached to them, care being taken not to injure the parent plant. If they spring from a thick root it is not to be wantonly severed, but the soil should be removed, and the sucker taken off by cutting away a clean slice of the root, which will then heal and sustain no harm. Stem suckers are such as proceed from the base of the stem, as is often seen in the case of the currant and lilac. They should be removed in any case; when required for propagation they should be taken with all the roots attached to them, and they should be as thoroughly disbudded below ground as possible, or they are liable to continue the habit of suckering. In this case, too, the soil should be carefully opened and the shoots removed with a suckering iron, a sharp concave implement with long iron handle. When the number of roots is limited, the tops should be shortened, and some care in watering and mulching should be bestowed on the plant if it is of value.

(6) *By Runners*.—The young string-like shoots produced by the strawberry are a well-known example of suckers. The process of rooting those runners should be facilitated by fixing them close down to the soil, which is done by small wooden hooked pegs or by stones; hairpins, short lengths of bent wire, etc., may also be used. After the roots are formed, the strings are cut through, and the runners become independent plants.

(7) *By Proliferous Buds*.—Not unlike the runner, though growing in a very different way, are the bud-plants formed on the fronds of several kinds of ferns belonging to the genera *Asplenium*, *Woodwardia*, *Polystichum*, *Lastrea*, *Adiantum*, *Cystopteris*, etc. In some of these (*Adiantum caudatum*, *Polystichum lepidocaulon*) the rachis of the frond is lengthened out much like the string of the strawberry runner, and bears a plant at its apex. In others (*Polystichum angulare proliferum*), the stipes below and the rachis among the pinnæ develop buds, which are often numerous and crowded. In others again (*Woodwardia orientalis*, *Asplenium bulbiferum*), buds are numerous produced on the upper surface of the fronds. These will develop on the plant if allowed to remain. For propagation the bulbiferous portion is pegged down on the surface of a pot of suitable soil; if kept close in a moist atmosphere, the little buds will soon strike root and form independent plants. In the *Cystopteris* the buds are deciduous, falling off as the fronds acquire maturity, but, if collected and pressed into the surface of a pot of soil and kept close, they will grow up into young plants the following season.

(8) *By Layers*.—Layering consists in preparing the branch of a plant while still attached to the parent, bending it so that the part operated on is brought under ground, and then fixing it there by means of a forked peg. Some plants root so freely that they need only pegging down; but in most cases the arrest of the returning sap to form a callus, and ultimately young roots, must be brought about artificially, either by twisting the branch, by splitting it, by girdling it closely with wire, by taking off a ring of bark, or by "tonguing." In tonguing the leaves are cut off the portion which has to be brought under ground, and a tongue or slit is then cut from below upward close beyond a joint,

of such length that, when the cut part of the layer is pegged an inch or two (or in larger woody subjects three or four inches) below the surface, the elevation of the point of the shoot to an upright may open the incision, and thus set it free, so that it may be surrounded by earth to induce it to form roots. The whole branch, except a few buds at the extremity, is covered with soil. The best seasons for these operations are early spring and midsummer, that is, before the sap begins to flow, and after the first flush of growth has passed off. One whole summer, sometimes two, must elapse before the layers will be fully rooted in the case of woody plants; but such plants as carnations and picotees, which are usually propagated in this way, in favorable seasons take only a few weeks to root, as they are layered toward the end of the blooming season in July, and are taken off and planted separately early in the autumn.

In general, each shoot makes one layer, but in plants like the *Wistaria* or *Clematis*, which make long shoots, what is called serpentine layering may be adopted; that is, the shoot is taken alternately below and above the surface, as frequently as its length permits. There must, however, be a joint at the underground part where it is to be tongued and pegged, and at least one sound bud in each exposed part, from which a shoot may be developed to form the top of the young plant.

(9) *By Circumposition*.—When a plant is too high or its habit does not conveniently admit of its being layered, it may often be increased by what is called circumposition, the soil being carried up to the branch operated on. The branch is to be prepared by ringing or notching or wiring as in layering, and a temporary stand made to support the vessel which is to contain the soil. The vessel may be a flower-pot sawn in two, so that the halves may be bound together when used, or it may be a flower-pot or box with a side slit which will admit the shoot; this vessel is to be filled compactly with suitable porous earth, the opening at the slit being stopped by pieces of slate or tile. The earth must be kept moist, which is perhaps best done by a thick mulching of moss, the moss being also bound closely over the openings in the vessel, and all being kept damp by frequent syringings. Reid remarks of this method of propagation that he has effected it with clay and cowdung, well mixed, after the bark had been taken off all around, and wrapped about with a double or triple swaddling of straw or hay rope.

(10) *By Grafts*.—Grafting is so extensively resorted to that it is impossible here to notice all its phases. It is perhaps of most importance as the principal means of propagating our hardy kinds of fruit, especially the apple and the pear; but the process is the same with most other fruits and ornamental hardy trees and shrubs that are thus propagated. The stocks are commonly divided into two classes:—(1) free stocks, which consist of seedling plants, chiefly of the same genus or species as the trees from which the scions are taken; and (2) dwarfing stocks, which are of more diminutive growth, either varieties of the same species or species of the same or some allied genus as the scion, which have a tendency to lessen the expansion of the engrafted tree. The French Paradise is the best dwarfing stock for apples, and the quince for pears. In determining the choice of stocks, the nature of the soil in which the grafted trees are to grow should have full weight. In a soil, for example, naturally moist, it is proper to graft pears on the quince, because this plant not only thrives in such a soil but serves to check the luxuriance thereby produced. The scions should always be portions of the wood of the preceding year, selected from healthy parents; in the case of shy-bearing kinds, it is better to

obtain them from the fruitful branches. The scions should be taken off some weeks before they are wanted, and half-buried in the earth, since the stock at the time of grafting should in point of vegetation be somewhat in advance of the graft. During winter, grafts may be conveyed long distances, if carefully packed. If they have been six weeks or two months separated from the parent plant, they should be grafted low on the stock, and the earth should be ridged up around them, leaving only one bud of the scion exposed above ground. The best season for grafting apples and similar hardy subjects is the month of March; but it may be commenced as soon as the sap in the stock is fairly in motion, and may be continued during the first half of April.

Whip-grafting or *Tongue-grafting* is the most usual mode of performing the operation. The stock is headed off by an oblique transverse cut as shown at *a*, a slice is then pared off the side as at *b*, and on the face of this a tongue or notch is made, the cut being in a downward direction; the scion *c* is pared off in a similar way by a single clean sharp cut, and this is notched or tongued in the opposite direction as the figure indicates; the two are then fitted together as shown at *d*, so that the inner bark of each may come in contact at least on one side, and then tied around with damp, soft bast as at *e*; next some grafting clay is taken on the forefinger and pushed down on each side so as to fill out the space between the top of the stock and the graft, and a portion is also rubbed over the ligatures on the side where the graft is placed, a handful of the clay is then taken, flattened out, and rolled closely round the whole point of junction, being finished off to a tapering form both above and below, as shown by the dotted line *f*. To do this deftly, the hands should be plunged from time to time in dry ashes, to prevent the clay from sticking to them.

Cleft-grafting is another method in common use. The stock *a* is cut down from the horizontal cut *d*, and the scion, when cut to a thin wedge form, as shown at *c* and *e*, is inserted into the cleft; the whole is then bound up and clayed as in the former case. This is not so good a plan as whip-grafting; it is improved by sloping the stock on one side to the size of the graft.

Crown-grafting or *Rind-grafting* is preferable to cleft-grafting, inasmuch as it leaves no open spaces in the wood. The stock *b* is cut off horizontally or nearly so, and a slit is then cut in the bark *f, f*, a wedge-shaped piece of ivory being inserted to raise the bark; the scion is then cut to the same wedge-shaped form *g, h*, and inserted in the space opened for it between the albumen and the bark, after which it is tied down and clayed over in the manner already described.

Side-grafting is performed like whip-grafting, the graft being inserted on the side of a branch and not at the cut end of the stock. It may be practiced for the purpose of changing a part of the tree, and is sometimes very useful for filling out vacant spaces, in trained trees especially.

Inarching is another form of side-grafting. Here the graft is fixed to the side of the stock, which is planted or potted close to the plant to be worked. The branches are applied to the stock while yet attached to the parent tree, and remain so until united. In the case of trained trees, a young shoot is sometimes inarched to its parent stem to supply a branch where one has not been developed in the ordinary way.

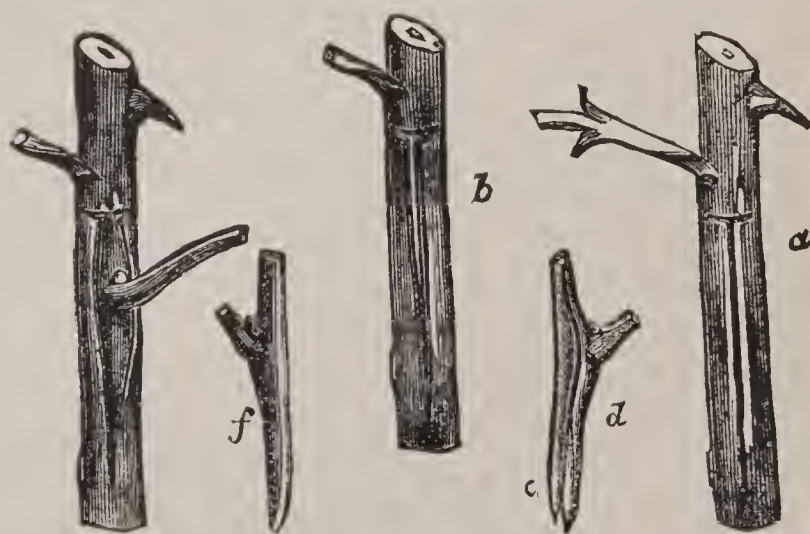
For the propagation by grafts of stove and greenhouse plants the process adopted is whip-grafting or a modification of it. The parts are, however, so small that the tongue of the graft is dispensed with, and the two stems simply pared smooth and bound together. In this way hardy rhododendrons of choice sorts, greenhouse aza-

leas, the varieties of the orange family, camellias, roses, rare conifers, and numerous other plants are increased. In small subjects soft cotton is used for tying instead of bast, and grafting-wax is substituted for grafting-clay. The best is the French cold mastic "L'Homme Lefort." All grafting of this kind is done in the propagating house, at any season when grafts are obtainable in a fit state—the plants when operated on being placed in close frames warmed to a suitable temperature.

Root-Grafting is sometimes resorted to where extensive increase is an object, or where stem-grafting or other means of propagation are not available. In this case the scion is grafted directly onto a portion of the root of some appropriate stock, both graft and stock being usually very small; the grafted root is then potted so as to cover the point of junction with the soil, and is plunged in the bed of the propagating house, where it gets the slight stimulus of a gentle bottom heat. Dahlias and peonies may be grafted by inserting young shoots into the neck of one of the fleshy roots of each kind respectively—the best method of doing so being to cut a triangular section near the upper end of the root, just large enough to admit the young shoot when slightly pared away on two sides to give it a similar form. In the case of large woody plants thus worked the grafted roots, after the operation is completed, are planted in nursery beds, so that the upper buds only are exposed to the atmosphere, as shown at *c* in the figure.

(II) *By Buds*.—Budding is the inserting of a bud cut with a portion of bark of the plant to be propagated into the bark of the stock, where it is bound gently but firmly. Some fruits, such as peaches, apricots, plums, cherries, etc., are propagated in this way, as well as roses, and many other plants. In the propagating house budding may be done at any season when the sap is in motion; but for fruit-trees, roses, etc., in the open air, it is usually done in July or August, when the buds destined for the following year are completely formed in the axils of the leaves, and when the bark separates freely from the wood it covers. Those buds are to be preferred, as being best ripened, which occur on the middle portion of a young shoot.

The simplest and most generally practiced form of budding is that called *Shield-budding* or *T-budding*.



Shield-Budding.

The operator should be provided with a budding-knife in which the cutting edge of the blade is rounded off at the point, and which has a thin ivory or bone handle, for raising the bark of the stock. A horizontal incision is made in the bark quite down to the wood, and from this a perpendicular slit is drawn downward to the extent of perhaps an inch, so that the slit has a resemblance to the letter T, as at *a*. A bud is then cut by a clean incision from the tree intended to be propagated, having a proportion of the wood attached to it, and so that the whole may be an inch and a half long, as at *d*.

The bit of wood *e* must be gently withdrawn, care being taken that the bud adheres wholly to the bark or shield, as it is called, of which *f* is a side view. The bark on each side of the perpendicular slit being then cautiously opened, as at *b*, with the handle of the knife, the bud and shield are inserted as shown at *c*. The upper tip of the shield is cut off horizontally, and brought to fit the bark of the stock at the transverse incision. Slight ties of soft cotton wool or worsted, or even moist bast-matting, are then applied. In about a month or six weeks the ligatures may be taken away, when, if the operation has been successful, the bud will be fresh and full, and the shield firmly united to the wood. In the following spring, a strong shoot will be thrown out, and to this the stock is headed down by gradations during the course of the summer.

To be successful the operation should be performed with a quick and light hand, so that no part of the delicate tissues be injured, as would happen if they were left for a time exposed, or if the bud were forced in like a wedge. The union is effected as in grafting, by means of the organizable sap or cambium, and the less this is disturbed until the inner bark of the shield is pressed and fixed against it the better. Inverted T-budding, in which the two incisions are in the form **T**, is for some reasons preferable to the more ordinary method.

(12) *By Branch Cuttings.*—Propagation by cuttings is the mode of increase most commonly adopted, next to that by seeds. It is effected by taking a portion from a branch or shoot of the plant, and placing it in the soil. There are great differences to be observed in the selection and treatment of cuttings. Sometimes soft green shoots, as in *Verbena* (fig. *a*), are used; sometimes the shoots must be half-ripened, and sometimes fully matured. So of the mode of preparation; some will root if cut off or broken off at any point and thrust into wet earth or sand in a warm place (fig. *a*); others require to be cut with the utmost care just below a joint or leaf-base, and by a keen blade so as to sever the tissues without tearing or bruising; and others again after being cut across require to be split up for a short distance. It is usual and in most cases necessary to cut away the lower portion of a cutting up to just below the node or joint (fig. *b*, *d*, *e*). The internodal parts will not often divide so as to form separate individual plants; sometimes, however, this happens; it is said that the smallest piece of *Torenia asiatica*, for instance, will grow. Then as to position, certain cuttings grow readily enough if planted outdoors in the open soil, some preferring shade, others sunshine, while less hardy subjects must be covered with a bell-glass, or must be in a close atmosphere with bottom heat, or must have the aid of pure silver sand to facilitate their rooting (fig. *c*). Cuttings should in all cases be taken from healthy plants, and from shoots of a moderate degree of vigor. It is also important to select leafy growths, and not such as will at once run up to flower. Young shoots which have become moderately firm generally make the best cuttings, but sometimes the very softest shoots strike more readily. For all plants in a growing state spring is the safest time for taking cuttings.

Cuttings of deciduous plants should be taken off after the fall of the leaf, and should have all underground buds carefully removed so as to prevent, as far as possible, the formation of suckers. These cuttings should be about one foot in length, and should be planted at once in the ground so as to leave only the top with the two or three preserved buds exposed. If a clean stem, however, is desired, a longer portion may be left uncovered.

Cuttings of growing plants are prepared by removing

with a sharp knife, and moderately close, the few leaves which would otherwise be buried in the soil; they are then cut clean across just below a joint; the fewer the leaves thus removed, however, the better, as if kept from being exhausted they help to supply the organizable matter out of which the roots are formed. Free-rooting subjects strike in any lightish, sandy mixture; but difficult subjects should have thoroughly well-drained pots, a portion of the soil proper for the particular plants made very sandy, and a surfacing of clean, sharp silver sand and about as deep as the length of the cutting.

(13) *By Leaf Cuttings.*—Many plants may be propagated by planting their leaves or portions of their leaves as cuttings, as, for example, the herbaceous *Gloxinia* (fig. *a*) and *Gesnera*, the succulent *Sempervivum*, *Echeveria*, *Pachyphytum*, and their allies, and such hard-leaved plants as *Theophrasta* (fig. *b*). The leaves are best taken off with the base whole, and should be planted in well-drained sandy soil; in due time they form roots, and ultimately from some latent bud a little shoot which forms the young plant. The treatment is precisely like that of branch cuttings. Gloxinias, begonias, etc., grow readily from fragments of the leaves cut clean through the thick veins and ribs, and planted edge wise like cuttings.



Leaf Propagation.

This class of subjects may also be fixed flat on the surface of the cutting pot, by means of little pegs or hooks, the main ribs being cut across at intervals, and from these points roots and eventually young tubers will be produced. (See illustration, "Leaf Propagation.")

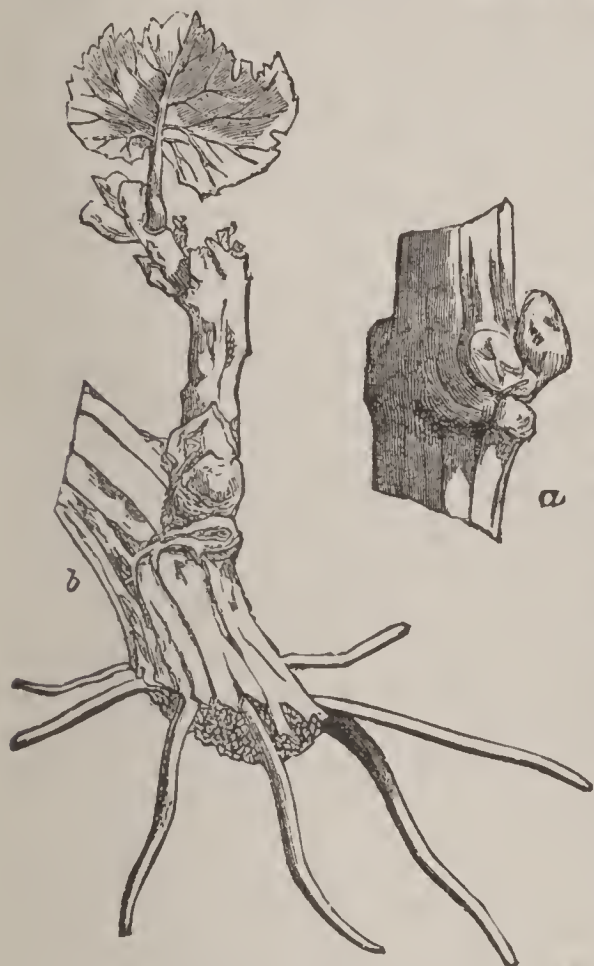
(14) *By Root Cuttings.*—Some plants which are not easily increased by other means propagate readily from root cuttings. Among the indoor plants which may be so treated, the *Bouvardia*, *Pelargonium*, *Aralia*, and *Wigandia* may be mentioned. The *modus operandi* is to turn the plant out of its pot, shake away the soil so as to free the roots, and then select as many pieces of the stouter roots as may be required. These are cut up into half-inch lengths (sometimes less) and inserted in light sandy soil around the margin of a cutting pot, so that the upper end of the root cutting may be level with the soil or only just covered by it. The pots should be watered so as to settle the soil, and be placed in the close atmosphere of the propagating pit or frame, where they will need scarcely any water until the buds are seen pushing through the surface.

There are various herbaceous plants which may be similarly treated, such as sea-kale and horseradish, and, among ornamental plants, the beautiful autumn-blooming *Anemone japonica* and *Senecio pulcher*. The sea-kale and horseradish require to be treated in the open garden, where the cut portions should be planted in lines in well-worked soil; but the roots of the *Anemone* and *Senecio* should be planted in pots and kept in a close frame with a little warmth till the young shoots have started.

Various hardy ornamental trees are also increased in this way, as the quince, elm, robinia, and mulberry, and the rose among shrubs. The most important use to which this mode of propagation is put is, however, the increase of roses, and of the various plums used as stocks for working the choicer stone fruits. The method in the latter case is to select roots averaging the thickness of the little finger, to cut these into lengths of about three or four inches, and to plant them in lines just beneath the surface in nursery beds. The root

cuttings of rose-stocks are prepared and treated in a similar way.

(15) *By Cuttings of Single Eyes.*—This mode of propagation is performed by cutting the branches into short lengths, each containing one well-matured bud or eye, with a short portion of the stem above and below. It is a common mode of propagating vines, the eyes being in this case cut from the ripened leafless wood.



Cutting of Single Eye.

The eyes (fig. *a*) are planted just below the surface in pots of light soil, which are placed in a hotbed or propagating pit, and in due time each pushes up a young shoot which forms the future stem, while from about its base the young roots are produced (fig. *b*) which convert it into an independent plant. In the case of plants with persistent leaves, the stem may be cut through just above and below the bud, retaining the leaf which is left on the cutting, the old wood and eye being placed beneath the soil and the leaf left exposed. In this way the india-rubber tree (*Ficus elastica*), for example, and many other tender plants may be increased with the aid of a brisk bottom heat. Many of the free-growing soft-wooded plants may also be grown from cuttings of single joints of the young wood, where rapid increase is desired; and in the case of opposite-leaved plants two cuttings may often be made from one joint by splitting the stem longitudinally, each cutting consisting of a leaf and a perfect bud attached to half the thickness of the stem.

22. *Planting and Transplanting.*—In preparing a fruit tree for transplantation, the first thing to be done is to open a trench round it at a distance of from three to four feet, according to size. The trench should be opened to about two spades' depth, and any coarse roots which may extend thus far from the trunk may be cut clean off with a sharp knife. The soil between the trench and the stem is to be reduced as far as may seem necessary or practicable by means of a digging fork, the roots as soon as they are liberated being fixed on one side and carefully preserved. By working in this way all around the ball, the best roots will be got out and preserved, and the ball lightened of all superfluous soil. The tree will then be ready to lift if carefully prized up from beneath the ball, and if it does not lift readily, it will probably be found that a root has struck downward, which will have to be sought out and cut through. Whenever practicable, it is best to secure a ball of earth around the roots. On the tree being lifted from its hole the roots should be examined, and all which have been severed roughly with the spade should have the ends cut smooth with the knife to facilitate the emission of

fibers. The tree can then be transported to its new position. The hole for its reception should be of sufficient depth to allow the base of the ball of earth, or of the roots, to stand so that the point whence the uppermost roots spring from the stem may be two or three inches above the general surface level. Then the bottom being regulated so as to leave the soil rather highest in the center, the plant is to be set in the hole in the position desired, and steadied there by hand. Next the roots from the lower portion of the ball are to be sought out and laid outward in lines radiating from the stem, being distributed equally on all sides as nearly as this can be done; some fine and suitable good earth should be thrown among the roots as they are thus being placed, and worked in well up to the base of the ball. The soil covering the roots may be gently pressed down, but the tree should not be pulled up and down, as is sometimes done, to settle the soil. This done, another set of roots higher up the ball must be laid out in the same way, and again another, until the whole of the roots, thus carefully laid, are embedded as firmly as may be in the soil, which may now receive another gentle treading. The stem should next be supported permanently, either by one stake or by three, according to its size. The excavation will now be filled up about two-thirds perhaps; and, if so, the tree may have a thorough good watering, sufficient to settle the soil closely about its roots. After twenty-four hours the hole may be leveled in, with moderate treading, if the water has soaked well in, the surface being left slightly sloping upward toward the stem of the tree. In transplanting trees of the ornamental class, less need be attempted in respect to providing new soil, although the soil should be made as congenial as practicable.

In transplanting smaller subjects, such as plants for the flower garden, much less effort is required. The plant must be lifted with as little injury to its rootlets as possible, and carefully set into the hole, the soil being filled in round it, and carefully pressed close by the hand. For moving small plants the garden trowel is a very convenient tool, but we are inclined to give the preference to the hand-fork. For larger masses, such as strong-growing herbaceous plants, a spade or digging-fork will be requisite.

When seedlings of vigorous plants have to be "pricked out," a dibble is the best implement to be used. The ground being prepared and, if necessary, enriched, and the surface made fine and smooth, a hole is made with the dibble deep enough and large enough to receive the roots of the seedling plants without doubling them up, and the hole is filled in by working the soil close to the plant with the point of the dibble. The pricking out of seedlings in pots in the propagating pit is effected in a similar way. The plants, indeed, often require to be removed and set from half an inch to an inch apart before they have become sufficiently developed to admit of being handled with any degree of facility, and for these a pointed stick of convenient size is used as a dibble. In extreme cases it is best to lift the little seedling on the end of a flattish pointed stick, pressing this into the new soil where the plant is to be placed, and liberating it and closing the earth about it by the aid of a similar stick held in the other hand.

Large trees may be successfully transplanted by the aid of transplanting machines, of which different forms are in use. These will be found figured and described in the various horticultural and arboricultural publications. The best season for transplanting deciduous trees is during the early autumn months. As regards evergreens opinions are divided, some preferring August and September, others April or May. They can be successfully planted at either period, but for subjects

which are at all difficult to remove the spring months are to be preferred.

23. *Potting and Repotting.*—Garden pots are made with a comparatively large hole in the bottom, and those of the largest size have also holes at the side near the bottom; these openings are to prevent the soil becoming saturated or soured with superabundant water. To prepare the pot for the plant, a broadish piece of potsherd called a "crock," is placed over the large hole, and if there be side holes they are also covered. The bottom crock is made from a piece of a broken garden pot, and is laid with the convex side upward; then comes a layer of irregular pieces of crock of various sizes, about



Section of Pot Showing CROCKS.

an inch deep in a five-inch pot, two inches in an eleven-inch or twelve-inch pot, etc. A few of the coarser lumps from the outer edge of the heap of potting soil are spread over the crocks. The same end, that of keeping the finer particles of the soil from mixing with the drainage crocks, may be attained by shaking in a little clean moss. A handful or two of the soil is then put in, and on this the plant with its roots spread out is to be set a trifle higher than the plant should stand in the pot when finished off; more soil is to be added, and the whole pressed firmly with the fingers, the base of the stem being just below the pot-rim, and the surface being smoothed off so as to slope a little outward. When finished off, the pots should be well watered, to settle the soil; but they should stand till the water has well drained away, since, if they are moved about while the fresh soil is very wet, there will be a risk of its becoming puddled or too much consolidated. Larger plants do not need quite such delicate treatment, but care should be taken not to handle the roots roughly. The soil for these should be less comminuted, and the amount of drainage material more ample. Larger bodies of soil also require to be more thoroughly consolidated before watering; otherwise they would settle down so as to leave an unsightly void at the pot-rim.

Some plants, especially when potted temporarily, may be dealt with in a simpler way. A single crock may be used in some cases, and in others no crock at all, but a handful of half-decayed leaves or half-decayed dung thrown into the bottom of the pot. This mode of potting does well for bulbs, such as hyacinths, which are either thrown away or planted out when the bloom is over. The bedding plants generally may be potted in this way, the advantage being that at planting-out time there is less risk of disturbing the roots than if there were potsherds to remove. Plants of this character should be potted a little less firmly than specimens which are likely to stand long in the pot, and indeed the soil should be made comparatively light by the intermixture of leaf-mold or some equivalent, in order that the roots may run freely and quickly into it.

For epiphytal plants like orchids the most thorough drainage must be secured by the abundant use of potsherds, small pots being sometimes inserted inside the larger ones, or by planting in shallow pots or pans, so that there shall be no large mass of soil to get consolidated. For most of these the lightest spongy but sweet turfy peat must be used, this being packed lightly about the roots, and built up above the pot-rim, or in some cases freely mixed before use with chopped sphagnum moss and nodules of broken pots or of charcoal. The plants under these conditions often require to be supported by wooden pegs or sticks. Some of the species grow better when altogether taken out of

the soil and fixed to blocks of wood, but in this case they require a little coaxing with moss about the roots until they get established. In other cases they are planted in open baskets of wood or wire, using the porous peat and sphagnum compost. Both blocks and baskets are usually suspended from the roof of the house, hanging free, so that no accumulation of water is possible. In these cases, however, the greatest caution is necessary to prevent the plants from suffering from drought.

When repotting is adopted as a temporary expedient, as in the case of bedding-out plants which it is required to push forward as much as possible, it will suffice if provision is made to prevent the drainage hole from getting blocked, and a rich light compost is provided for the encouragement of the roots. When, however, a hard-wooded plant has to be repotted, the case is different; it may stand without further potting for one year or two years or more, and therefore much more care is necessary. The old ball of earth must be freed from all or most of the old crocks without doing injury to the roots, and the sharp edge of the upper surface gently rubbed off. If there be any sour or sodden or effete soil into which the roots have not run, this should be carefully picked out with a pointed stick. The ball is to be set on the new soil just high enough that when finished the base of the stem may be about level with the pot-rim, toward which the surface should slope gently, and the space between the old ball and the sides of the pot is to be filled in gradually with the prepared compost, which is from time to time to be pressed down with a blunt-ended flat piece of wood called a potting-stick, so as to render the new soil as solid as the old. The object of this is to prevent the plant from starving by the water applied all running off by way of the new soil, and not penetrating the original ball of earth. When this amount of pressure is necessary, especially in the case of loamy composts, the soil itself should be rather inclined to dryness, and should in no case be sufficiently moist to knead together into a pasty mass. In ordinary cases the potting soil should be just so far removed from dryness that when a handful is gently pressed it may hang together, but may lose its cohesion when dropped.

When plants are required to stand in ornamental china pots or vases, it is better both for the plants and for avoiding risk of breakage to grow them in ordinary garden pots of a size that will drop into the more valuable vessels. Slate pots or tubs, usually square, are sometimes adopted, and are durable and otherwise unobjectionable, only, their sides being less porous, the earth does not dry so rapidly, and some modification of treatment as to watering is necessary. For large conservatory specimens wooden tubs, round or square, are frequently used; these should be coated with pitch inside to render them more durable.

Various other contrivances take the place of garden pots for special purposes. Thus shallow square or oblong wooden boxes, made of light, inexpensive wood, are very useful for seed-sowing, for pricking out seedlings, or for planting cuttings. When the disturbance of the roots incidental to all transplanting is sought to be avoided, the seed or plant is started in some cases in squares of turf (used grassy side downward), which can when ready be transferred to the place the plant is to occupy. Cucumber and melon plants and vines reared from eyes are sometimes started in this way, both for the reason above mentioned, and because it prevents the curling of the roots apt to take place in plants raised in pots. Strips of turf are sometimes used for the rearing of early peas, which are sown in a warmish house or frame, and gradually hardened so as to bear exposure before removal to the open air.

24. *Watering.*—The guiding principle in watering plants is to do it thoroughly when it is required, and to abstain from giving a second supply till the first has been taken up.

When watering becomes necessary for kitchen-garden crops, the hose should be laid on and the lines of esculents allowed to drink their fill, if fresh succulent vegetables are desired. So also, if well-swelled and luscious fruits, such as strawberries, are required, there must be no parching at the roots. This applies even more strongly to conservatory borders and to forcing-houses than to the outside fruit-tree borders, because from these the natural rain supply is in most cases more distinctly cut off. In the case of forcing-houses, the water should be heated before being applied to the borders containing the roots of the trees.

In the watering of pot plants the utmost care is requisite if the plant be a shy-growing or valuable one, and yet it is almost impossible to give any intelligible instruction for performing the operation. The roots should never be suffered either to get thoroughly dry or to get sodden with excess of water. An adept will know by the ring of the pot on striking it with his knuckles whether water is wanted or not, according as it rings loud and clear or dull and heavy. With very choice subjects watering may be necessary two or three times a day in drying summer weather. It is a wrong though common practice to press the surface of the soil in the pot in order to feel if it is moist enough, as this soon consolidates it, and prevents it from getting the full benefit of aëration.

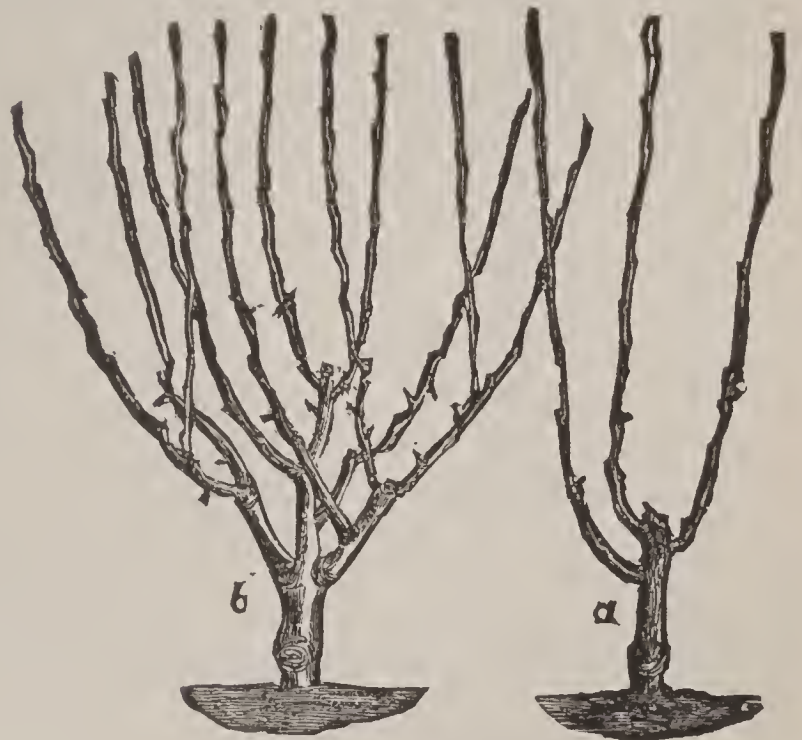
In all heated houses the water used should be warmed at least up to the temperature of the atmosphere, so as to avoid chilling the roots. This is also necessary in the case of water used for syringing the plants, which should be done two or three times a day in all stoves and forcing-houses, especially during the period when the young growth is being developed. The damping of all absorbent surfaces, such as the floors or bare walls, etc., is frequently necessary several times a day in the growing season, so as to keep up a humid atmosphere; hence the advantage of laying the floors a little rounded, as then the water draws off to the sides against the curbstone, while the center remains dry for promenaders.

In cooler structures it becomes necessary in the dull season of the year to prevent the slopping of water over the plants or on the floor, as this tends to cause "damping off,"—the stems assuming a state of mildewy decay, which not infrequently, if it once attacks a plant, will destroy it piece by piece. For the same reason cleanliness and free ventilation are of great importance.

25. *Pruning.*—Pruning is a very important operation in the fruit garden, its object being twofold—(1) to give form to the tree, and (2) to induce the free production of flower buds as the precursors of a plentiful crop of fruit. To form a standard tree, either the stock is allowed to grow up with a straight stem, by cutting away all side branches up to the height required, say about six feet, the scion or bud being worked at that point, and the head developed therefrom; or the stock is worked close to the ground, and the young shoot obtained therefrom is allowed to grow up in the same way, being pruned in its progress to keep it single and straight, and the top being cut off when the desired height is reached, so as to cause the growth of lateral shoots. If these are three or four in number, and fairly balanced as to strength and position, little pruning will be required. The tips of unripened wood should be cut back about one-third their length at an outwardly placed bud, and the chief pruning thereafter required will be to cut away inwardly directed shoots which cross

or crowd each other and tend to confuse the center of the tree. Bushy heads should be thinned out, and those that are too large cut back so as to remodel them. If the shoots produced are not sufficient in number, or are badly placed, or very unequal in vigor, the head should be cut back moderately close, leaving a few inches only of the young shoots, which should be pruned back to buds so placed as to furnish shoots in the positions desired. When worked at the top of a stem formed of the stock, the growth from the graft or bud must be pruned in a similar way. Three or four leading shoots should be selected to pass ere long into boughs and form a well-balanced skeleton for the tree; these boughs, however, will soon grow beyond any artificial system the pruner may adopt.

To form a dwarf or bush fruit tree the stock must be worked near the ground, and the young shoot produced from the scion or bud must be cut back to whatever height it is desired the dwarf stem should be, say one and one-half to two feet. The young shoots produced from the portion of the new wood retained are to form the skeleton of the bush tree, and must be dealt with as in the case of standard trees. The growth of inwardly



Dwarf-Tree Pruning.

directed shoots is to be prevented, and the center kept open, the tree assuming a cup-shaped outline. The illustration of dwarf pruning, reduced from M. Hardy's excellent work, *Traité de la Taille des Arbres Fruitières*, will give a good idea how these dwarf trees are to be manipulated, *a* showing the first year's development from the maiden tree after being headed back, and *b* the form assumed a year or two later.

In forming a pyramidal tree, the lateral growths, instead of being removed, as in the standard tree, are encouraged to the utmost; and in order to strengthen them the upper part of the leading shoot is removed annually, the side branches being also shortened somewhat as the tree advances in size. In illustration of pyramid pruning, reduced from M. Hardy's work, *a* shows a young tree with its second year's growth, the upright shoot of the maiden tree having been moderately headed back, being left longer if the buds near the base promise to break freely, or cut shorter if they are weak and wanting in vigor. The winter pruning, carried out with the view to shape the tree into a well-grown pyramid, would be effected at the places marked by a cross line. The lowest branch would have four buds retained, the end one being on the lower side of the branch. The two next would be cut to three buds, which here also

are fortunately so situated that the upper one is on the lower side of the branches. The fourth is not cut at all, its terminal bud being allowed to grow to draw strength into it. The fifth is an example where the



Pyramid Pruning.

bud to which the shoot should be cut back is wrongly placed; a shoot resulting from such a cut is apt instead of growing outward to grow erect, and lead to confusion in the form of the tree, to avoid which it is tied down in its proper place during the summer by a small twig. The upper shoots are cut closer in. Near the base of the stem are two prominent buds, which would produce two vigorous shoots, but these would be too near the ground, and the buds should therefore be suppressed; but, to strengthen the lower part, the weaker buds just above and below the lowest branch should be forced into growth, by making a transverse incision close above each. In the illustration, *b* shows what a similar tree would be at the end of the third year's growth.

In order to bring a young tree into the cordon shape, all its side branches are shortened back, either to form permanent spurs, as in the case of pears, or to yield annual young shoots, as in peaches and nectarines. The single-stemmed cordon may be trained horizontally, obliquely at any required angle, or vertically if required, the first two arrangements being preferable. If a double cordon is required, the original young stem must be headed back, and the two best shoots produced must be selected, trained right and left, and treated as for the single cordon.

The forms chiefly adopted for trees trained to walls and espalier rails are the fan-shaped, the half-fan, and the horizontal, with their various modifications.

Of late years the close pruning of the young trees has been objected to, and the "extension system" has, in many cases, been adopted. The maiden tree is headed down, and two shoots led away right and left. Two

laterals should be allowed to grow from the upper side of them, one from near the base, the other from near the middle, all others being pinched out beyond the second or third leaf during summer, but cut away to the last bud in winter. The tree will thus consist of six shoots probably three feet to four feet long, which are not to be pruned unless they are unequal in strength, a defect which is rather to be remedied by summer pinching than by winter pruning. The second year three young shoots are to be left on each of the six, one close to the base, one about the middle, and one at the point, the rest being rubbed off. These three shoots will produce laterals, of which one or two may be selected and laid in; and thus a number of moderately strong fertile shoots will be obtained, and at the end of the season a comparatively large tree will be the result.

The method of pruning formerly adopted for the formation of a fan-shaped tree was to head down the maiden plant to about two eyes, so placed as to yield a young shoot on each side, the supernumerary shoots being rubbed off while quite young, and the reserved shoots trained against the wall during the summer so as to get them well matured. The next year they were cut back again, often nearly to the base, in order that the lower pair of these shoots might each produce two well-placed young shoots, and the upper pair three young shoots. The tree would thus consist of ten shoots, to be laid out at regular distances, and then if closely cut the skeleton of the tree would be as in second figure. These main shoots were not again to be shortened back, but from each of them three young shoots were to be selected and trained in two, on the upper side, one near the base, and the other half way up, and one on the lower side placed about midway between these two; these with the leading shoot, which was also to be nailed in, made four branches of the current year from each of the ten main branches, and the form of the tree would therefore be that of third figure. The other young shoots produced were pinched off while quite young, to throw all the strength of the tree into those which were to form its basis, and to secure abundant light and air. In after years the leading shoot was not to be cut back, but all the lateral shoots were to be shortened, and from these year by year other shoots were to be selected to fill up the area occupied by the tree.

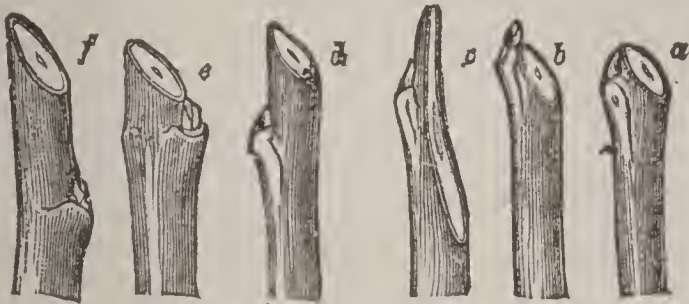
In pruning for a horizontal tree the young maiden tree has to be headed back nearly to its base, and from the young shoots three are to be selected, the two best placed lower ones to form an opposite or nearly opposite pair of main branches, and the best placed upper one to continue the erect stem. This upper shoot is at the next winter pruning to be cut down to within about a foot of the point whence it sprung, and its buds rubbed off except the upper one for a leader, and one on each side just below it to furnish another pair of side shoots; these being trained in position, the tree would appear as in second figure. The same course is to be followed annually till the space is filled. Sometimes in very favorable soils and with vigorous trees two pairs of branches may be obtained in one season by summer-stopping the erect shoots and selecting others from the young growths thus induced, but more commonly the trees have to be built up by forming one pair of branches annually. The shoots are not at first lowered to the horizontal line, but are brought down gradually; and while the tree is being formed weak shoots may be allowed to grow in a more erect position than it is ultimately intended they should occupy. Thus in four or five years the tree will have acquired something the character of the third figure, and will go on thus increasing until the space is filled.

The half-fan is a combination of the two forms, but

as regards pruning does not materially differ from the horizontal, as two opposite side branches are produced in succession upward till the space is filled, only they are not taken out so abruptly, but are allowed to rise at an acute angle and then to curve into the horizontal line.

In all the various forms of cordons, in horizontal training, and in fan and half-fan training, the pruning of the main branches when the form of the tree is worked out will vary in accordance with the kind of fruit under treatment. Thus in the peach, nectarine, apricot, plum, and cherry, which are commonly trained fan-fashion, the first two will have to be pruned so as to keep a succession of young annual shoots, these being their fruit-bearing wood. The others are generally pruned so as to combine a moderate supply of young wood with a greater or less number of fruit spurs. In the pear and apple the fruit is borne principally on spurs, and hence what is known as spur-pruning has to be adopted, the young shoots being all cut back nearly to their base, so as to cause fruit buds to evolve from the remaining eyes or buds. Cordons of apples and pears have to be similarly treated, but cordons of peaches and nectarines are pruned so as to provide the necessary annual succession of young bearing wood.

Cuts—Good and Bad.—The nature of the cut itself in pruning is of more consequence, especially in the case of fruit trees, than at first sight may appear. The branches should be separated by a clean cut at an angle of about 45° , just at the back of a bud, the cut entering on a level with the base of the bud and passing



Cuts—Good and Bad.

out on a level with its top (fig. *a*), for when cut in this way the wound becomes rapidly covered with new wood, as soon as growth recommences, whereas if the cut is too close the bud is starved, or if less close an ugly and awkward snag is left. Figs. *b* and *c* are examples of the former, and *d*, *e*, *f* of the latter.

In the case of fruit trees, and indeed of deciduous plants generally, pruning requires to be done during the winter or resting period, and the earlier in that period the better, as then the buds become plump and full of sap, and produce strong shoots when the time for growth arrives. If, on the contrary, it is done while the plant is in full growth, the whole system of the tree sustains a check, the circulation is deranged, the quality of the sap becomes deteriorated, and a dead stump or unhealthy shoot is the frequent result. This, however, does not apply to the pruning of the herbaceous or succulent growths of the current season, nor to soft-wooded plants generally, for this kind of pruning, called summer pruning, is essential to the formation of handsome specimens of the latter, and is a very important help in the formation of the fruit or blossom buds of fruit trees.

Summer Pruning should be performed while the shoots are yet young and succulent, so that they may in most cases be nipped off with the thumb-nail. It is very necessary in the case of trees trained to a flat surface, as a wall or espalier rail, to prevent undue crowding. In some cases, as, for example, with peaches, the superfluous shoots are wholly removed, and certain selected shoots reserved to supply bearing

wood for next year. In others, as pears, the tops of the young shoots are removed, leaving three or four leaves and their buds at the base, to be developed into fruit buds by the additional nourishment thus



Summer Pruning for Spurs.

thrown into them (fig. *a*). One or two may push out a late summer growth, *b*; this will serve as a vent for the vigor of the tree, and if the lowermost only go to the formation of a fruit spur, the object will have been gained. They are cut to the last dormant bud in winter.

But summer pruning has been much extended since the introduction of restricted growth and the use of dwarfing stocks. Orchard-house trees, and also pyramidal and bush trees of apples, pears and plums, are mainly fashioned by summer pruning; in fact, the less the knife is used upon them, except in the necessary cutting of the roots in potted trees, the better. In the case of orchard-house plants no shoots are suffered to lengthen out, except as occasionally wanted to fill up a gap in the outline of the tree. On the contrary, the tops of all young shoots are pinched off when some three or four leaves are formed, and this is done again and again throughout the season. When this pruning is just brought to a balance with the vigor of the roots, the consequence is that fruit buds are formed all over the tree, instead of a thicket of sterile and useless wood. Pyramidal and bush trees out of doors are, of course, suffered to become somewhat larger, and sufficient wood must be allowed to grow to give them the form desired; but after the first year or two, when the frame work is laid out, they are permitted to extend very slowly, and never to any great extent, while the young growths are continually nipped off, so as to clothe the branches with fruit buds as closely placed as will permit of their healthy development.

The *Pruning of Flowering Plants* is generally a much lighter matter than the pruning of fruit-trees. If a young seedling or cutting of any soft-wooded plant is to be bushy, it must have its top nipped out by the thumb-nail or pruning-scissors at a very early age, and this stopping must be repeated frequently. If what is called a well-furnished plant is required, an average of from two to three inches is all the extension that must be permitted—sometimes scarcely so much—before the top is nipped out; and this must be continued until the desired size is attained, whether that be large or small. Then generally the plant is allowed to grow away till bloom or blooming shoots are developed. To form a pyramidal plant, which is a very elegant and useful shape to give to a decorative pot plant, the main stem should be encouraged to grow upright, for a length perhaps of six or eight inches before it is topped; this induces the formation of laterals, and favors their development. The best-placed upper young shoot is selected and trained upright to a slender stake, and this also is topped when it has advanced six or eight inches further, in order to induce the laterals on the second portion to push freely. This process is continued till the required size is gained. With all the difficult and slow-growing plants of the hard-wooded section, all the pruning must

be done in this gradual way in the young wood as the plant progresses.

Root Pruning is most commonly practiced in fruit-tree cultivation. It is often resorted to as a means of restoring fertility in plants which have become over-rank and sterile in growth. The effect of it, or of transplanting, is to reduce the supply of crude sap to the branches, and consequently to cause a check in their development. In root-pruning all roots that have struck downward into a cold, uncongenial subsoil must be pruned off if they cannot be turned in a lateral direction, and all the lateral ones that have become coarse and fiberless must also be shortened back by means of a clean cut with a sharp knife, while some hard rubbly material may if necessary be put under the tree before it is again planted, all its roots being laid out laterally, radiating as equally as possible from the center. The operation is best performed early in autumn, and may be safely resorted to in the case of fruit-trees of moderate age, and even of old trees if due care be exercised. In transplanting trees all the roots which may have become bruised or broken in the process of lifting should be cut clean away behind the broken part, as they then more readily strike out new roots from the cut parts. In all these cases the cut should be a clean sloping one, and made in an upward and outward direction.

The root-pruning of pot-plants is necessary in the case of many soft-wooded subjects which are grown on year after year—pelargoniums and fuchsias, for example.

After the close pruning of the branches to which they are annually subjected, and when the young shoots have shot forth an inch or two in length, they are turned out of their pots and have the old soil shaken away from their roots, the longest of which, to the extent of about half the existing quantity, are then cut clean away, and the plants repotted into small pots. This permits the growing plant to be fed with nice fresh soil, without having been necessarily transferred to pots of unwieldy size by the time the flowering stage is reached.

Ringing.—One of the expedients for inducing a state of fruitfulness in trees is the ringing of the branches or stem, that is, removing a narrow annular portion of the bark, by which means, it is said, the trees are not only rendered productive, but the quality of the fruit is at the same time improved. The advantage depends on the obstruction given to the descent of the sap. The ring should be cut out in spring, and be of such a width that the bark may remain separated for the season. A tight ligature of twine or wire answers the same end. The advantages of the operation may perhaps be gained by judicious root-pruning, and it is not at all adapted for the various stone fruits.

26. *Training*.—What is called training is the guiding of the branches of a tree or plant in certain positions which they would not naturally assume, the object being partly to secure their full exposure to light, and partly to regulate the flow and distribution of the sap. To secure the former object, the branches must be so fixed as to shade each other as little as possible, and to realize the second, the branches must have given to them an upward or downward direction, as they may require to be encouraged or repressed. Something of the same vegetative vigor which is given to a plant or tree by hard pruning is afforded by training in an upward direction so as to promote the flow of the sap; while the repression effected by summer pruning is supplemented by downward training, which acts as a check. One main object is the preservation of the equilibrium in the growth of the several parts of the tree; and for this various minor details deserve attention. Thus a shoot will grow more vigorously while waving in the air than when nailed close to the wall; consequently a weak shoot

should be left free, while its stronger antagonist should be restrained; and a luxuriant shoot may be retarded for some time by having its tender extremity pinched off to allow a weaker shoot to overtake it.

Mr. Robert Thompson, who is to be regarded as an authority, says:—

“A fair exposure to light is one of the principal objects to be borne in mind in training; but the branches may be well regulated as regards exposure to light,

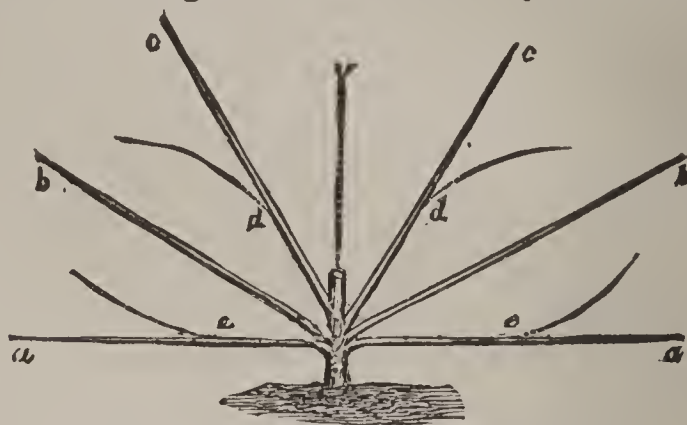


Diagram Illustrating Branch Distribution.

without being equally so with respect to the flow of sap. For instance, they may be disposed like the radii of a circle touching the circumference at equal distances (see illustration, *aa*, *bb*, *cc*, *v*). We shall, however, suppose that the central vertical shoot *v* has been cut back nearly to its base in order to furnish from buds there situated the rudiments of other branches. The sap flows with much greater force into the upright or nearly upright branches than it does into those having a horizontal position; therefore branches radiating at equal distances, like those in the figure, would soon become very unequal in point of vigor; *cc* would of course be strong, *aa* comparatively weak, while *bb* would maintain a somewhat intermediate condition. If, instead of training the shoots *cc* in a straight direction, we depress them at *dd* and bend them in the growing season as indicated by the curved line toward *bb*, we shall greatly check their over-luxuriance. On the other hand, by elevating the horizontal shoots at *ee*, and training them in the direction of the dotted line toward *bb*, those shoots will be thereby greatly invigorated. In short, by curving the upper branches downward and the lower ones upward, the flow of sap is checked in the former and promoted in the latter; and the consequence is that *aa* and *cc* are equal to the medium *bb* and to each other.”

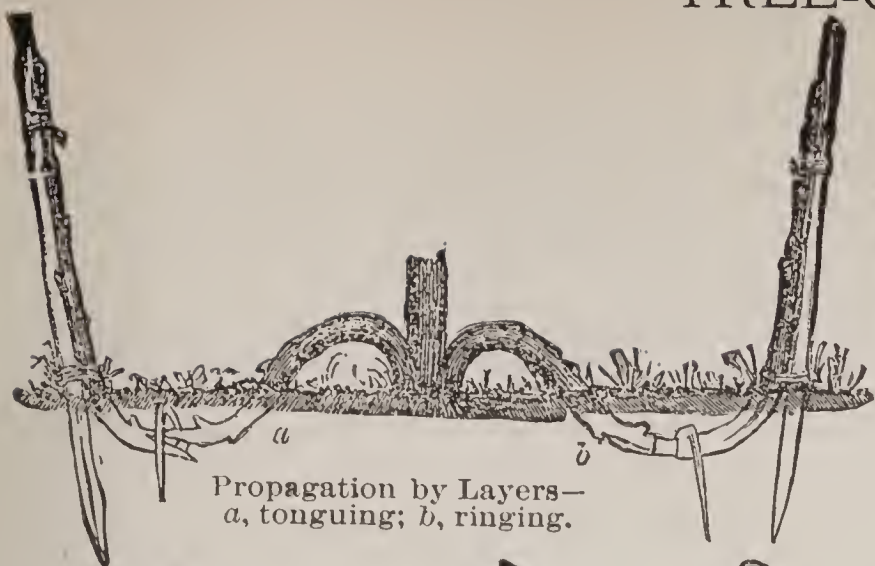
By these and other expedients, and by the prudent use of the knife, fruit-trees may be readily trained into the forms indicated below, which are among the best out of the many which have been devised.

The training of standard and bush trees in the open ground has been already referred to under the section *Pruning*. When the growth of pyramids is completed, the outline is something like that of illustration, and very pretty trees are thus formed. It is better, however, especially if the tendency to bear fruit is rather slack, to adopt what the French call *en quenouille* training, which consists in tying or weighting the tips of the branches so as to give them all a downward curve. Pear-trees worked on the quince stock, and trained *en quenouille*, are generally very fertile.

Wall-trees, it must be evident, are placed in a very unnatural and constrained position, and would in fact soon be reduced to a state of utter confusion, if allowed to grow unrestricted; hence the following modes of training have been adopted.

Horizontal Training has long been a favorite form in England. There is one principal ascending stem from which the branches depart at right angles, at intervals of about a foot. Horizontal training is best adapted to

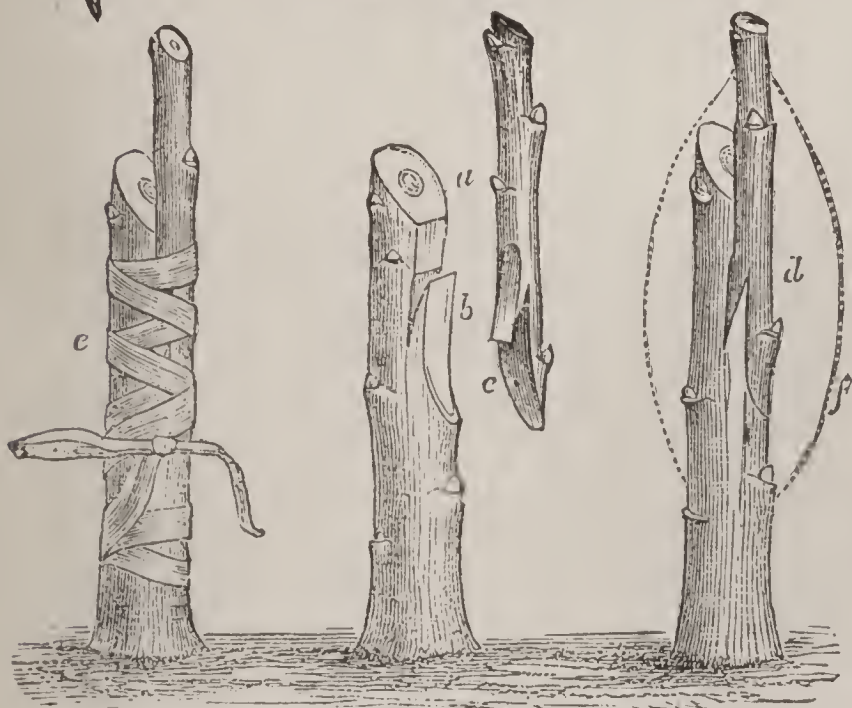
TREE-GRAFTING.



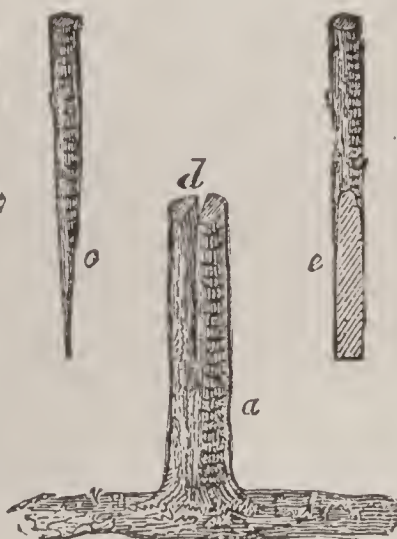
Propagation by Layers—
a, tonguing; b, ringing.



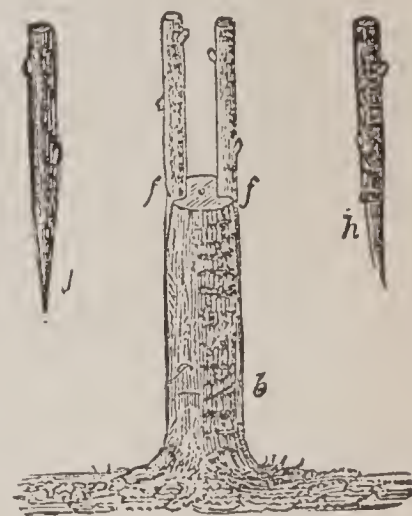
Propagation by Cuttings.



Whip-Grafting or Tongue-Grafting.



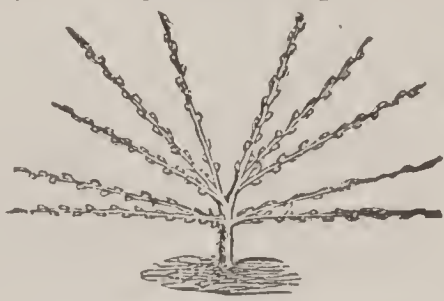
Cleft-Grafting.



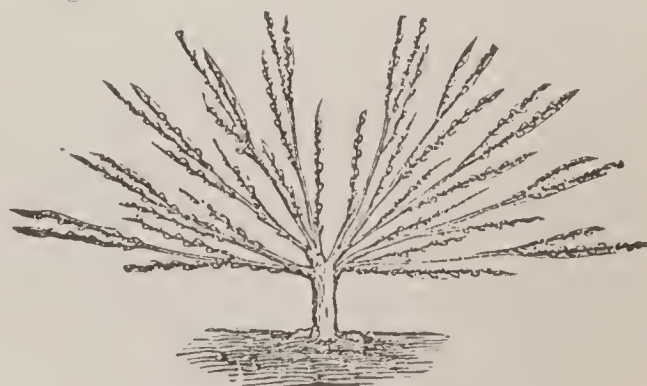
Crown-Grafting.



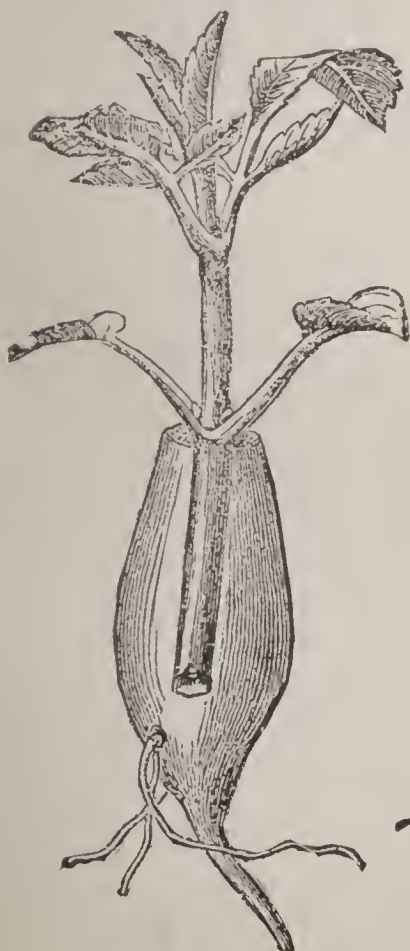
Pruning for
Fan-shaped Tree.



The same—Third Year.



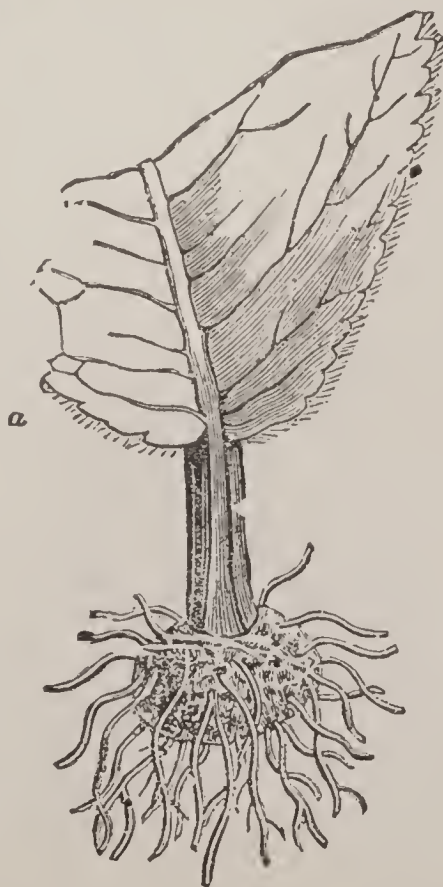
The same—Fourth Year.



Root-Grafting
of Dahlia.



Root-Grafting of
Woody Plant.



Leaf Cuttings.

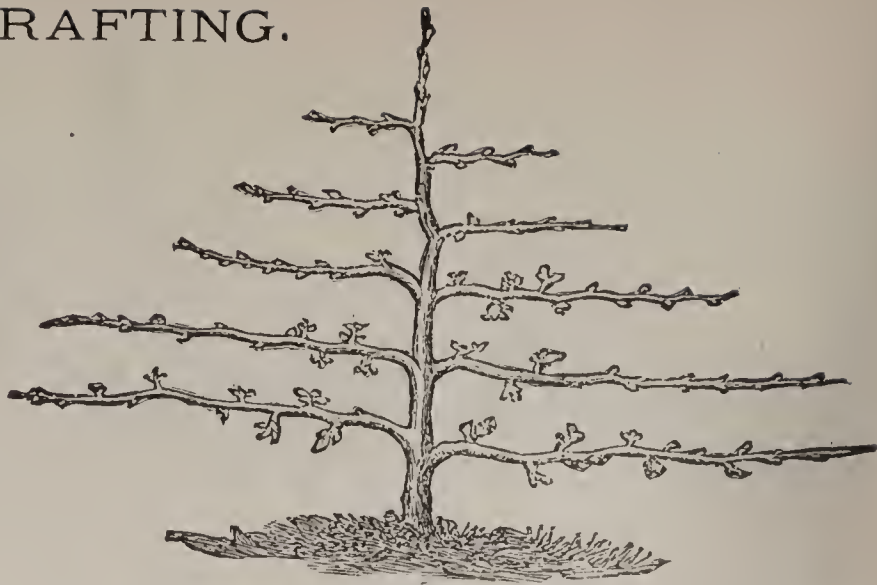
TREE-GRAFTING.



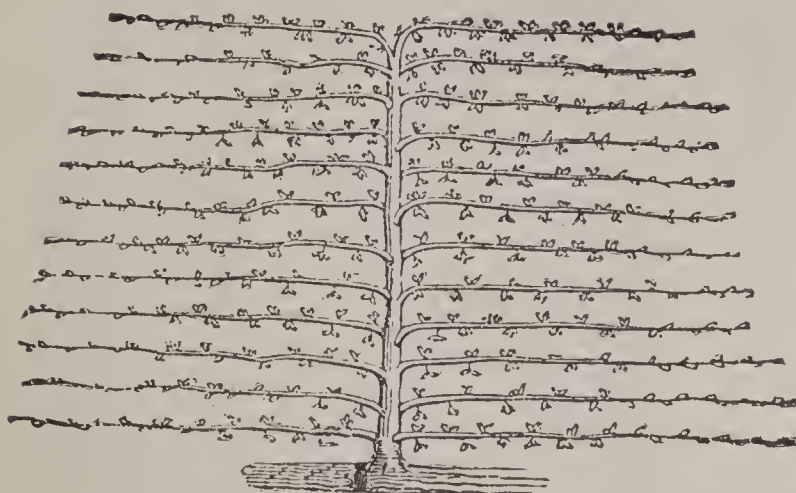
Pruning for Horizontally-Trained Tree.



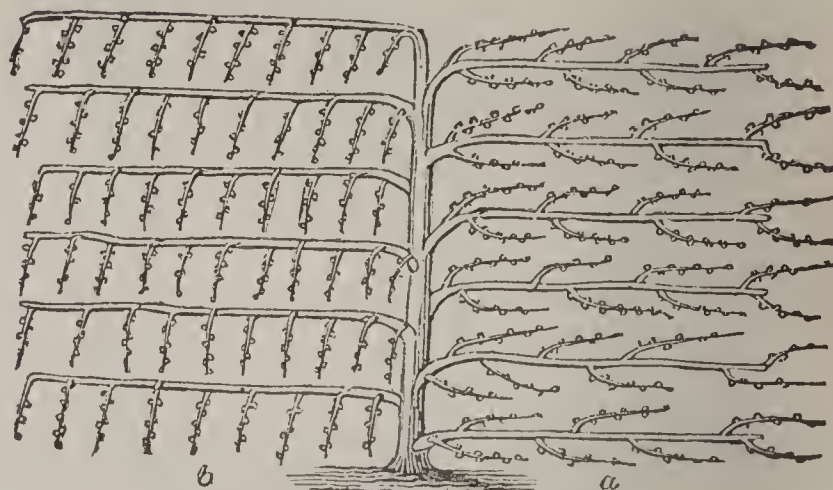
The same—Third Year.



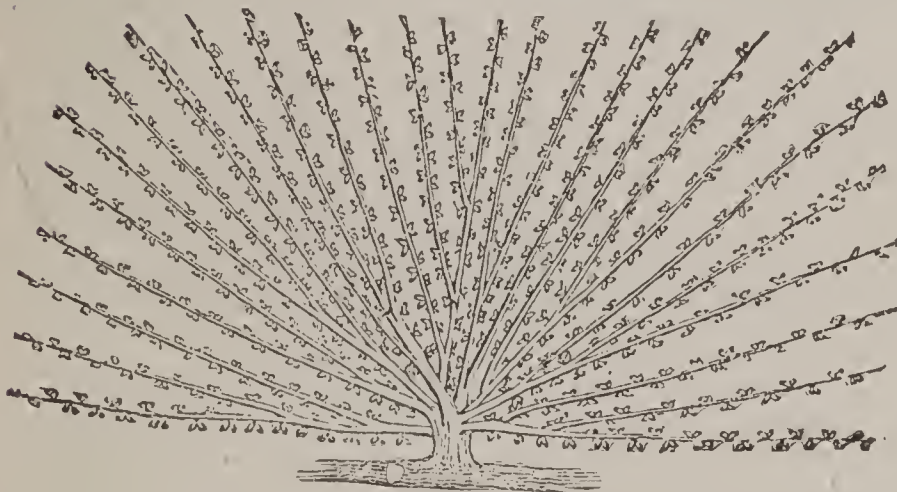
The same—Fifth Year.



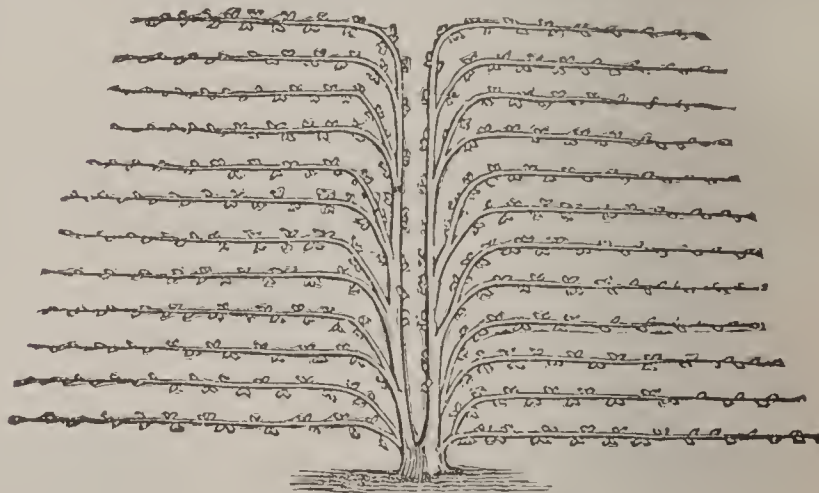
Horizontal Training.



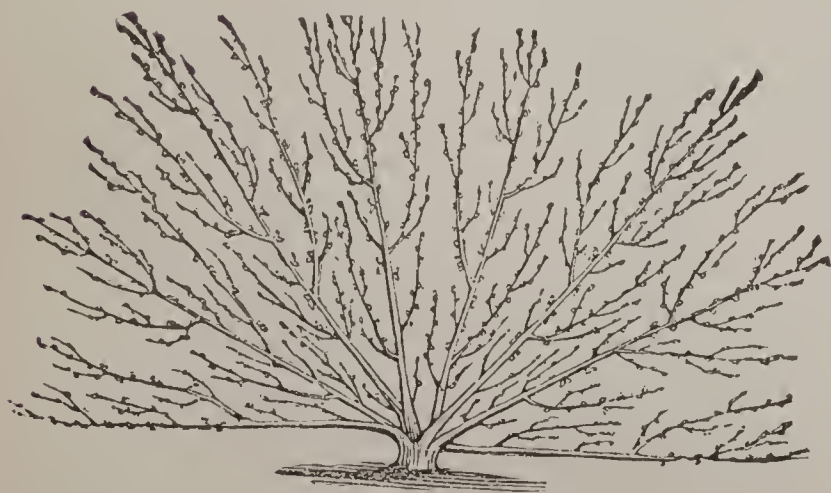
Forms of Horizontal Training.



Fan Training.



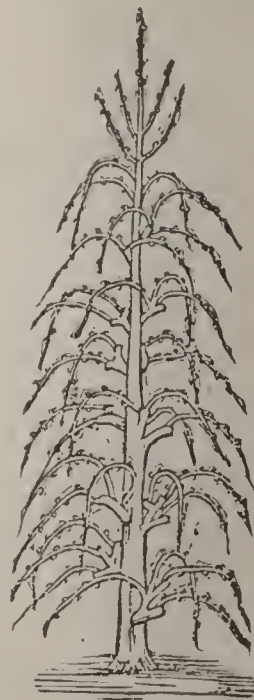
Half-Fan Training.



Modified Fan Training.



Pyramidal Training.



Training en trennoille.

the apple and the pear; and for the more twiggy growing slender varieties, the forms shown in second cut on that subject have been recommended. In these the horizontal branches are placed wider, eighteen to twenty inches apart, and the smaller shoots are trained between them, either on both sides, as at *a*, or deflexed from the lower side, as at *b*. The latter is an excellent method of reclaiming neglected trees. Every alternate branch should be taken away, and the spurs cut off, after which the young shoots are trained in, and soon produce good fruit.

In *Fan Training* there is no leading stem, but the branches spring from the base and are arranged somewhat like the spokes of a fan. This mode of training is commonly adopted for the peach, nectarine, apricot, and Morello cherry, to which it is best adapted. Though sometimes adopted, it is not so well suited as the horizontal form for apples and pears, because, when the branches reach the top of the wall, where they must be cut short, a *tête de saule* or hedge of young shoots, is inevitable. A modification, of the fan shape is sometimes adopted for stone fruits, such as the apricot. In this the object is to establish a number of mother branches, and on these to form a series of subordinate members, chiefly composed of bearing wood. The mother branches or limbs should not be numerous, but well marked, equal in strength, and regularly disposed. The side branches should be pretty abundant, short, and not so vigorous as to rival the leading members.

The *Half-fan* mode of training, which is intermediate between horizontal and fan training, is most nearly allied to the former, but the branches leave the stem at an acute angle, a disposition supposed to favor the more equal distribution of the sap. Sometimes two vertical stems are adopted, but there is no particular advantage in this, and a single-stemmed tree is more manageable. The half-fan form is well adapted for such fruits as the plum and the cherry; and, indeed, for fruits of vigorous habit, it seems to combine the advantages of both the foregoing.

Trees must be fixed to the walls and buildings, against which they are trained by means of nails and shreds, or in cases where it is desired to preserve the wall surface intact, by permanent nails or studs driven in in regular order. Sometimes the walls are furnished with galvanized wires, but this has been objected to as causing cankering of the shoots, for which, however, painting is recommended as a remedy, and which is also avoided, it is said, by crossing the tying material between the wire and the wood, and so preventing them from coming in contact. If they are adopted, the wires should be close to the wall to prevent a cold draught between it and the tree. Care should be taken that the ties or fastenings do not eventually cut into the bark as the branches swell with increased age. When shreds and nails are used, cast wall nails and "medicated shreds" are the best; the nails should be of small size for the young shoots.

For tying plants to trellises and stakes nothing is better than soft tarred twine. Osier ties are sometimes used for espaliers. The training in of summer shoots on wall-trees is often done by means of slender twigs; indeed the prunings of the trees themselves, stripped of their leaves, often serve the purpose very well; the ends are tucked under the adjacent fixed shoots, the young shoots to be fastened in being thus held close to the wall. Crooked shoots should be straightened at the principal or winter training; this is done by pulling the convex side toward the straight line desired by means of the tie or shred, the next above and below being set so as to pull in the opposite direction.

In training greenhouse plants the young branches should be drawn outward by means of ties fastened to a

string or wire under the pot-rim; the center then fills up, and slender stakes are used as required; but the fewer these are in number the better. Climbers are trained from the bottom around or across trellises, of which the cylindrical or the balloon-shaped, or sometimes the flat oval or circular, are the best forms. The size should be adapted to the habit of the plant, which should cover the whole by the time flowers are produced. Bast fiber and raphia fiber are to be preferred for light subjects of this character, as they can be split to any degree of fineness; but the latter is not durable enough or strong enough for coarse-growing border flowers. Very durable trellises for greenhouse climbers are made of slender round iron rods for standards, having a series of hooks on the inner edge, into which rings of similar metal are dropped; the rings may be graduated so as to form a broad open top, or may be all of the same size, when the trellis will assume the cylindrical form.

The training of bedding plants over the surface of the soil is done by small pegs of birch wood or bracken, by loops of wire, or sometimes by loops of bast having the ends fixed in the soil by the aid of the dibble. The object is to fill up the blank space as quickly and as evenly as possible.

27. *Forcing* is the accelerating, by special treatment, of the growth of certain plants, which are required to be had in leaf, in flower, or in fruit before their natural season — as, for instance, the leaves of mint at Easter-tide or the leafstalks of sea-kale and rhubarb at Christmas, the flowers of summer in the depth of winter, or some of the choicest fruits perfected so much before their normal period as to complete, with the retarded crops of winter, the circle of the seasons.

There are some few subjects which when forced do not require a light house. Thus among flowers the white blossoms of the lilac, so much prized during winter, are produced by forcing the plant in darkness. Rhubarb and sea-kale among esculents both need to be forced in darkness to keep them crisp and tender, and mushrooms also are always grown in dark structures. In fact, a roomy mushroom house is one of the most convenient of all places for forcing the vegetables just referred to. The lilac would be better placed in a dark shed heated to about 60°, in which some dung and leaves could be allowed to lie and ferment, giving off both a genial heat and moisture.

One of the most important preliminaries to successful forcing is the securing to the plants a previous state of rest. The thorough ripening of the preceding season's wood in fruit trees and flowering plants, and of the crown in perennial herbs like strawberries, and the cessation of all active growth before the time they are to start into new growth, are of paramount importance. The ripening process must be brought about by free exposure to light, and by the application of a little extra heat with dryness, if the season should be unfavorable; and both roots and tops must submit to a limitation of their water supply. When the ripening is perfected, the resting process must be aided by keeping the temperature in which they await the forcing process as low as each particular subject can bear.

V. Flowers.

28. *Flower Garden and Pleasure Grounds.*—Wherever there is a flower garden of considerable magnitude, and in a separate situation, it should be constructed on principles of its own. The great object must be to exhibit to advantage the graceful forms and glorious hues of flowering plants and shrubs.

When the garden is upon a large scale, and especially where a natural inclination of the ground exists, or can

be formed artificially, terraces and parapet walls should be introduced, with flights of steps, and embellishments in connection with them, such as fountains, statuary, sculpture, etc. Grass terraces alone have a mean appearance in such a position. The parapet walls afford excellent accommodation for half-hardy and beautiful flowering plants.

With regard to flower-plots, when the figures are separated by turf, it is necessary that the little lawns or glades should have a certain degree of breadth, as nothing has a worse effect than overcrowding. A multitude of little figures should also be avoided, as they produce the disagreeable effect well named by Gilpin "spottiness." In this sort of flower garden it is desirable that a gravel walk should skirt at least one side of the principal figures, for in a humid climate the grass would otherwise render them inaccessible with comfort during a great part of the year. In those gardens where turf is wholly or partly excluded, the compartments should be of a larger and more massive character. Narrow borders, bounded by parallel straight lines and concentric curves, should be avoided. The centers of the figures should be filled with tall-growing shrubs, and even with an occasional low evergreen tree, such as a yew or a holly. The walks, arranged in long concave curves, may communicate here and there with one another. A dial, a few seats and arbors, with an urn or two or a vase, may be introduced with good effect.

29. *Fruits Important to Man.*—The list of the fruits of any importance is much shorter than would at first be supposed, as may be seen from the following enumeration.

I. *Indigenous or Cultivated:* (1) *Apples or Pip-fruits.*—Apple (*Pyrus Malus*), Pear (*P. communis*), Medlar (*Mespilus germanica*), Quince (*Cydonia vulgaris*).

(2) *Stone-fruit.*—Peach and Nectarine (*Persica vulgaris*), Apricot (*Prunus armeniaca*), Plum (*P. institia*), Cherry (*P. Cerasus* and *P. avium*), Damson (*P. domestica*), Greengage (*P. italica*), Sloe (*P. spinosa*) Cherry-plum (*P. cerasifera*), etc.

(3) *Berries.*—Grape (*Vitis vinifera*), Strawberry (*Fragaria vesca*, *elatior*, etc.), Raspberry (*Rubus Idæus*), Bramble or Blackberry (*R. fruticosus*), Gooseberry (*Ribes Grossularia*), Red Currant (*R. rubrum*), Black Currant (*R. nigrum*), Barberry (*Berberis vulgaris*), Black Mulberry (*Morus nigra*), White Mulberry (*M. alba*), Bilberry or Blaeberry (*Vaccinium Myrtillus*) with its minor congeners, Juniper (*Juniperus communis*).

(4) *Nuts or Shell-fruit.*—Hazel-nut (*Corylus Avellana*), Filbert (*C. tubulosa*), Walnut (*Juglans regia*).

II. *More Important Fruits of Warm, Temperate, and Tropical Regions:* (1) *Stone-fruit.*—Date (*Phoenix dactylifera*), Olive (*Olea europæa*), Mango (*Mangifera indica*), Tahiti-apple (*Spondias dulcis*), Mombin Plum of West Indies (*S. Mombin*), Avocado Pear (*Persea gratissima*), Icaco or Cocoa Plum (*Chrysobalanus icaco*), Sapota Apple (*Achras Sapota*).

(2) *Berries and Berry-like Fruit* (in widest sense of succulence).—Banana and Plantain (*Musa paradisiaca*), Pine-apple (*Ananassa sativa*), Fig (*Ficus Carica*), Bread-fruit (*Artocarpus incisa* and *integri-folia*), Custard Apple (*Anona squamosa*, etc.), Baobab (*Adansonia digitata*), Orange, Lemon, Lime, Citron, Shaddock, Pomelmoose, Forbidden Fruit, Bergamot, and other species of *Citrus*, Pomegranate (*Punica granatum*), Guava (*Psidium piriferum*), Rose-apple of East Indies, (*Fambosa domestica* and *vulgaris*), Tamarind (*Tamarindus indica*), Carob or Locust Bean

(*Ceratonia siliqua*), Papaw (*Carica Papaya*), Pumpkin (*Cucurbita Pepo*, etc.), Melon (*Cucumis Melo*), Water-melon (*C. Citrullus*), Cucumber (*C. sativus*), Tomato (*Lycopersicum esculentum*), Lotus (*Diospyros lotus*), Jujube (*Zizyphus vulgaris*), Mangosteen (*Garcinia Mangostana*), Prickly Pear (*Opuntia vulgaris*).

(3) *Nuts or Shell-fruit.*—Cocoa-nut (*Cocos nucifera*), Almond (*Amygdalus communis*), Chestnut (*Castanea vesca*), Litchi or Lee-Chee (*Nephelium Litchi*), (really however, a shelled drupe), Brazil-nut (*Bertholletia excelsa*), etc.

Chemical Composition of Fruits.—Our knowledge of the chemistry of fruit may be dated from the analyses of Fresenius (1857). But because of the innumerable varieties of almost every cultivated fruit, the effects of different soils and climates upon these, and still more of the fluctuation due to better or worse seasons, the results of any one chemical analysis would tend to convey an idea of undue precision. Thus *e. g.*, while the ratio of sugar to free acid in certain grapes of an ordinary wine-year was found to be 16 to 18, in a very bad year it sank to 12, and in a very good year rose to 24. Hence a broad outline may be of more general use than the statistics of any one analysis.

The percentage of water may be taken as varying from 78 to 80 in the grape and cherry, as from 82 to 85 in plums, peaches, apples, and pears, as 82 to 87 in brambles, currants, etc., and as much as 95 in the water-melon. The proportion of insoluble residue—skin and cellulose, stone and seed—obviously also varies greatly with succulence and ripeness, but may be taken, one fruit with another, at not less than from 4 to 6 per cent. Unripe fruits may contain a notable proportion of starch, but this is fermented on ripening into glucose and other sugars, fruit-sugar, grape-sugar, cane-sugar, or (in *Sorbus*) sorbin. The only fruits which retain starch in important quantity are those of the banana, bread-fruit tree, and baobab; hence the exceptional nutritive value of these. The olive alone yields a notable proportion of oil. The proportion of sugars varies exceedingly, dates, dry figs (48 per cent.), and raisins (56 per cent.), again very important foods, heading the list. Grapes of course stand high, from 12 to 18, indeed sometimes as much as 26 per cent., cherries from 8 to 13 apples 6 to 8, pears 7 to 8, plums 6, red currants 4.75, greengage 3.5, peach and apricot only 1.5. The proportion of pectin bodies is, however, exceedingly notable, especially in fruits such as the three last named. In unripe fruits (as also in roots) we find *pectose*, a body apparently related to cellulose, but easily transmuted by a natural ferment or by boiling with dilute acid into pectin, $C_4H_6O_4$, and its allies. These are all more or less soluble in water, with which they readily form a jelly (whence the peculiar consistency of our fruit-preserves). The proportion of soluble pectin and gum varies considerably and is of great importance to the blandness and agreeableness of fruit, the harder and more common apples having considerably less than 3 per cent. and the best rennets nearly 8. The harsh red currant, indeed, like berries in general, has exceedingly little (0.25 per cent.); while the apricot has as much as 9, the greengage 12, and the peach 16—a circumstance which explains the peculiarly melting quality of these fruits, especially the last named. The free acid also varies greatly, from 2.4 per cent. in the red currant, 1.4 in the raspberry, and nearly as much in the sourest cherries, to 0.5 in sweet cherries and a minimum of 0.1 or less in the sweetest pears. That of apples and of grapes, of course, varies greatly, but both may generally be taken at from 1 to 0.75, while the apricot and peach stand at 0.3 or 0.4. The

acid is primarily malic, but citric, acetic, oxalic, tannic, and others may also be present.

The quantity of albuminoids is of course small, in fact inadequate to render most fruits a staple food. Yet it is by no means inappreciable, ranging from nearly .5 per cent. in the majority of fruits to .7 or .8 in the grape (2.7 in raisins), and above 1 in the melon and tomato. The quality of fruits depends largely upon the proportion of sugar, gum, and pectin to free acid, largely also upon the proportion of soluble to insoluble matters, but in very great measure also upon the aroma. This quality is due to the presence of characteristic ethers, often accompanied by essential oils.

VI. Fruits.

30. *Fruit-Tree Borders.*—No pains should be spared, in the preparation of fruit-tree borders, to secure their thorough drainage. The soil is sometimes placed upon a pavement flooring supported by stone or brick piers, with a cavity below of eighteen inches or two feet deep, into which air is admitted by small vertical eyes, placed along the edges of the walk, and covered with open iron gratings. This arrangement is expensive, and the same advantages can generally be secured by placing over the sloping bottom a good layer of coarse rubbly material, communicating with a drain in front to carry off the water, while earthenware drain tubes may be laid beneath the rubble from eight to ten feet apart, so as to form air drains, and provided with openings both at the side of the walk and also near the base of the wall. Over this rubbly matter, rough turfy soil, grass side downward, should be laid, and on this the good prepared soil in which the trees are to be planted. Such an elaborate system of drainage is necessary only in the case of adhesive clayey subsoils.

The borders should consist of three parts rich, turfy, calcareous loam, the top spit of a pasture, and one part light gritty earth, such as road-grit, with a small portion (one-sixth) of fine lime and brick rubbish. They should not be less than twelve feet in breadth, and may vary up to fifteen or eighteen feet, with a fall from the wall of about one inch in three feet. The border itself should be raised a foot or more above the general level. The bottom of the border, as well as that of the drain, must be kept lower than the general level of the subsoil, else the soakage will gather in all the little depressions of its surface. Fruit-tree borders should not be at all cropped with culinary vegetables, or very slightly so, as the process of digging destroys the roots of the trees, and drives them from near the surface, where they ought to be.

Shallow planting, whether of wall-trees or standards, is generally to be preferred, a covering of a few inches of soil being sufficient for the roots, but a surface of at least equal size to the surface of the hole should be covered with dung or litter so as to restrain evaporation and preserve moisture. In the case of wall-trees, a space of five or six inches is usually left between the stem at the insertion of the roots and the wall, to allow for increase of girth. Young standard trees should be tied to stakes so as to prevent their roots being ruptured by the wind-waving of the stems.

In the selection and distribution of fruit-trees regard must, of course, be had to local situation and climate. The best walls having a south or southeast aspect are devoted to the peach, apricot, and fig. Cherries and the generality of plums succeed very well either on an east or west aspect. In Scotland the mulberry requires the protection of a wall, and several of the finer apples and pears do not arrive at perfection without this help, and a tolerably good aspect. The wall-trees intended to be permanent are called dwarfs, from their branches

springing from near the ground. Between these, trees with tall stems, called riders, are planted as temporary occupants of the upper part of the wall. The riders should have been trained in the nursery into good-sized trees, in order that when planted out they may come into bearing as speedily as possible.

Standard Fruit-Trees should not be planted, if it can be avoided, in the borders of the kitchen garden, but in the outer slips, where they either may be allowed to attain their full size, or may be kept dwarfed. Each sort of fruit should be planted by itself, for the sake of orderly arrangement, and in order to facilitate protection when necessary by a covering of nets. Their produce is often superior in flavor to that of the same kind of fruit grown on walls.

VIII. Vegetables.

31. The list of vegetables is so long and the cultivation of the various species involves so many operations and requires so much technical knowledge, that our space will not permit us to do more than append a calendar of gardening seasons, including among other information the best times at which to begin the cultivation of the various kinds of plants included under that head. In addition we give a list of the less known "pot-herbs," together with a brief description of their appearance and uses.

32. CALENDAR FOR THE UNITED STATES (chiefly for the Latitude of New York).

JANUARY.

Flower Garden and Greenhouse.—Little is to be done in either. In the greenhouse care must be used to protect against frost. Ventilate but little, and with care; raise the ventilating sash only high enough to let the heated air from the greenhouse drive back the outer air so as not to chill the plants. To destroy the red spider, syringe the plants copiously at night, and splash the paths with water. The aphid, or "green fly," must also be destroyed; tobacco may be used. At this season, roses, grapevines, and other plants are often affected by mildew; an effectual remedy is to paint the hot-water pipes with a mixture of sulphur and lime, put on as thick as ordinary whitewash, once each week until it is checked; but care must be taken not to apply it on any surface at a higher temperature than 212°. Hyacinths and other bulbs that have been kept in a cellar or other dark, cool place may now be brought into the light of the greenhouse or sitting-room, provided they have filled the pots with roots. If they are not well rooted, leave them until they are, or select such of them as are best, leaving the others. In the outside flower garden little can be done, except that shrubs may be pruned, or new work, such as making walks or grading, performed, if weather permits.

Fruit Garden.—Pruning, staking up, or mulching can be done if the weather is such that the workmen can stand out. No plant is injured by being pruned in cold weather.

Grapery.—Graperies used for the forcing of foreign grapes may be started, beginning at a temperature of 50° at night, with 10° or 15° higher during the day. The borders must be covered sufficiently deep with leaves or manure to prevent the soil from freezing, as it would be destruction to the vines to start the shoots if the roots were frozen; hence, when forcing is begun in January, the covering should be put on in November, before severe frosts begin.

Vegetable Garden.—But little can be done in the Northern States, except to prepare manure, and get sashes, tools, etc., in working order; but in sections of the country where there is little or no frost the hardier kinds of seeds and plants may be sown and planted, such as asparagus, cabbage, cauliflower, carrot, leek, lettuce, onion, parsnip, peas, spinach, turnip, etc. In any section where these seeds can be sown in open ground, it is an indication that hotbeds may be started for the sowing of such tender vegetables as tomatoes, egg and pepper plants, etc., though, unless in the extreme Southern States, hotbeds should not be started before the beginning or middle of February.

FEBRUARY.

Flower Garden and Greenhouse.—The directions for January will in the main apply to this month, except that now some of the hardier annuals may be sown in hotbed or greenhouse, and also the propagation of plants by cuttings may be done rather better now than in January, as the greater amount of light gives more vitality to the cutting.

Fruit Garden.—But little can be done in most of the Northern States as yet, and in sections where there is no frost

in the ground it is likely to be too wet to work; but in many Southern States this will be the best month for planting fruit-trees and plants of all kinds, particularly strawberries, raspberries, blackberries, pear and apple trees, while grapevines will do, though they will also do well quite a month later.

Grapery.—The graperies started last month at 50° at night may now be increased to 60°, with a correspondingly higher day temperature. Great care must be taken to syringe the leaves thoroughly at least once a day, and to deluge the paths with water, so as to produce a moist atmosphere. Paint the hot-water pipes with sulphur mixture, as recommended in January.

Vegetable Garden.—Leaves from the woods, house manure, or refuse hops from breweries may be got together toward the latter part of this month, and mixed and turned to get "sweetened" preparatory to forming hotbeds. Cabbage, lettuce, and cauliflower seeds, if sown early this month in hotbed or greenhouse, will make fine plants if transplanted into hotbed in March. This is preferable to the use of fall-sown plants. Manure that is to be used for the crop should be broken up as fine as possible, for the more completely manure of any kind can be mixed with the soil the better the crop will be, and, of course, if it is dug or plowed in in large unbroken lumps it cannot be properly commingled.

MARCH.

Flower Garden and Greenhouse.—The long days and bright sunshine will now begin to tell on the plants under glass. Examine all plants that are vigorous and healthy; if the roots have matted the "ball" of earth they must be shifted into a larger-sized pot. Plants from cuttings struck last month may now be shifted and the propagation of all plants that are likely to be wanted should be continued. Hardier kinds of annuals may be sown; it is best done in shallow boxes, say two inches deep. Lawns can be raked off and mulched with short manure, or rich garden earth where manure cannot be obtained. Flower beds on light soil may be dug up so as to forward the work of the coming busy spring season.

Fruit Garden.—In many sections, planting may now be done with safety, provided the soil is light and dry, but not otherwise. Again, at this season, although a tree or plant will receive no injury when its roots are undisturbed in the soil should a frost come after planting, the same amount of freezing will and very often does greatly injure the plant if the roots are exposed.

Grapery.—The graperies started in January will have set its fruit, which should be thinned by one-third. The temperature may now be further advanced to 70° at night, with 15° higher in the daytime. The same precautions must be used against mildew and insects as given in January. Graperies wanted for succession may be started in February or this month.

Vegetable Garden.—This is a busy month. In localities where the frost is out of the ground, if it is not wet, seeds of the hardier vegetables can be sown. The list of seeds given for the Southern States in January may now be used at the North, while for most of the Southern States tender vegetables, such as egg plant, okra, sweet potatoes, melon, squash, potatoes, tomatoes, etc., may be sown and planted. Hotbeds must now be all started.

APRIL.

Flower Garden and Greenhouse.—Window and greenhouse plants require more water and ventilation. Due attention must be paid to shifting well-rooted plants into larger pots; and, if space is desired, many kinds of hardier plants can be safely put out in cold frames. Toward the end of the month it may be necessary to slightly shade the glass of the greenhouse. All herbaceous plants and hardy shrubs may be planted in the garden. The covering of leaves or litter should be taken off bulbs and tender plants that were covered up for winter, so that the beds can be lightly forked and raked. Sow tender annual flower seeds in boxes inside.

Fruit Garden.—Strawberries that have been covered up with straw or leaves should be relieved around the plants, leaving the covering between them. Raspberries, grapevines, etc., that have been laid down may now be uncovered and tied up to stakes or trellises, and all new plantations of these and other fruits may now be made.

Vegetable Garden.—Asparagus, rhubarb, spinach, etc., should be uncovered, and the beds hoed or dug lightly. Hardier sorts of vegetable seeds and plants such as beets, cabbage, cauliflower, celery, lettuce, onions, parsley, parsnip, peas, potatoes, radishes, spinach, turnip, etc., should all be sown or planted by the middle of the month if the soil is dry and warm, and, in all cases where practicable, before the end of the month. It is essential, in sowing seeds now, that they be well firmed in the soil. Any who expect to get early cabbage, cauliflower, lettuce or radishes, while planting or sowing is delayed until the time of sowing tomato and egg plant in May, are sure to be disappointed of a full crop.

MAY.

Flower Garden and Greenhouse.—Window and greenhouse plants should be in their finest bloom. Firing may be entirely dispensed with, though care must still be exercised in ventilating.

Every precaution must be used to keep the air moist. "Moss culture" may be tried, the common sphagnum of moss of the swamps, mixed with one-twentieth of its bulk of bonedust, being laid as a mulch on the top of the earth of the flower-pots; its effect is to shield the pots from the sun, and at the same time stimulate the roots to come to the surface. By the end of the month all of the plants that are wanted for the summer decoration of the flower border may be planted out, first loosening a little the ball of earth at the roots. If the weather is dry, water freely after planting. When the greenhouse is not to be used during the summer months, camellias, azaleas, and plants of that character should be set out of doors under partial shade, but most of the other plants usually grown in the conservatory or window garden in winter may be set in the open border. Flower beds should be kept well hoed and raked, to prevent the growth of weeds next month. Lawns should be mown, and the edgings trimmed. Pelargoniums, pinks, monthly roses, and all the half-hardy kinds of flowering plants should be planted early; but coleus, heliotrope, and the more tender plants should be delayed until the end of the month. Annuals that have been sown in the greenhouse or hotbed may be planted out, and seeds of such sorts as mignonette, sweet alyssum, phlox Drummondii, portulaca, etc., may be sown in the beds or borders.

Fruit Garden.—The hay or leaf mulching on the strawberry beds should be removed and the ground deeply hoed, after which it may be placed on again to keep the fruit clean and the ground from drying. Where it has not been convenient before, most of the smaller fruits may yet be planted during the first part of the month. Tobacco dust will dislodge most of the numerous kinds of slugs, caterpillars, or worms that make their appearance on the young shoots of vines or trees.

Vegetable Garden.—Attention should be given to new sowings and plantings for succession. Crops sown last month will have to be thinned out if large enough. Hoe deeply all transplanted crops, such as cabbage, cauliflower, lettuce, etc. Tender vegetables, such as tomatoes, egg and pepper plants, sweet potatoes, etc., can be planted out. Seeds of Lima beans, sweet corn, melon, okra, cucumbers, etc., should be sown; and sow for succession peas, spinach, lettuce, beans, radishes, etc., every ten days.

JUNE.

Flower Garden and Greenhouse.—Tropical plants can now be used to fill up the greenhouse during the summer months. It should be well shaded, and fine specimens of fancy caladiums, dracænas, coleus, crotons, palms, ferns and such plants as are grown for the beauty of their foliage will make a very attractive show. The "moss culture" will be found particularly valuable for these plants. Hyacinths, tulips, and other spring bulbs may be dug up, dried, and placed away for next fall's planting, and their places filled with bedding plants, such as coleus, achyranthes, pelargoniums, and the various white and colored leaf plants. It will be necessary to mow the lawn once a week.

Fruit Garden.—The small fruits should be mulched about the roots, if this has not yet been done. Grapevines outside as well as in should be disbudded.

Vegetable Garden.—Beets, beans, carrots, corn, cucumbers, lettuce, peas, and radishes may be sown for succession. This is usually a busy month, as many crops have to be gathered, and, if hoeing is not promptly seen to, weeds are certain to give great trouble. Tomatoes should be tied up to trellises or stakes if fine-flavored and handsome fruit is desired, for if left to ripen on the ground, they are apt to have a gross earthy flavor.

JULY.

Flower Garden and Greenhouse.—Watering, ventilating, and fumigating (or the use of tobacco in other forms for destruction of aphides) must be attended to. The atmosphere of the greenhouse must be kept moist. Watch the plants that have been plunged out of doors, and see if they require repotting. All plants that require staking, such as dahlias, roses, gladioli, and many herbaceous plants, should now be looked to. Carnations and other plants that are throwing up flower stems, if wanted to flower in winter, should be cut back, that is, the flower stems should be cut off to say five inches from the ground.

Fruit Garden.—If grapevines show any signs of mildew, dust them over with dry sulphur, selecting a still, warm day. The fruit having now been gathered from the strawberry plants, if new beds are to be formed, the system of layering the plants in small pots is the best. Where apples, pears, peaches, grapes etc., have set fruit thickly, thin out at least one-half or two-thirds of the young fruit.

Vegetable Garden.—The first days of this month will yet be time enough to sow sweet corn, beets, lettuce, beans, cucumbers, and ruta-baga turnips. Such vegetables as cabbage, cauliflower, celery, etc., wanted for fall or winter use, are best planted this month, though in some sections they will do later. Keep sweet potatoes hoed to prevent the vines rooting at the joints.

AUGUST.

Flower Garden and Greenhouse.—But little deviation is required in these departments from the instructions for July.

Fruit Garden.—Strawberries that have fruited will now be making "runners" or young plants. These should be kept cut close to the old plant, so that the full force of the root is expended in making the "crowns" or fruit buds for next season's crop. If plants are required for new beds, only the required number should be allowed to grow, and these should be layered in pots as recommended in July. The old stems of raspberries and blackberries that have borne fruit should be cut away, and the young shoots thinned to three or four canes to each hill or plant. If tied to stakes and topped when four or five feet high, they will form three or four branches on a cane, and will make stronger fruiting plants for next year.

Vegetable Garden.—Hoe deeply such crops as cabbage, cauliflower, and celery. The earthing up of celery this month is not to be recommended. Onions in many sections can be harvested. The proper condition is when the tops are turning yellow and falling down. They are dried best by placing them in a dry shed in thin layers. Sow spinach for fall use, but not yet for the winter crop. Redtop, white globe, and yellow Aberdeen turnips should now be sown; ruta-baga turnips sown last month will need thinning, and in extreme Southern States they may yet be sown.

SEPTEMBER.

Flower Garden and Greenhouse.—The flower beds in the lawn should be at their best. If planted in "ribbon lines" or "masses," strict attention must be given to pinching off the tops, so that the lines or masses will present an even surface. Tender plants will require to be put in the greenhouse or housed in some way toward the end of this month; but be careful to keep them as cool as possible during the day. Cuttings of bedding plants may now be made freely if wanted for next season, as young cuttings rooted in the fall make better plants for next spring's use than old plants, in the case of such soft-wooded plants as pelargoniums, fuchsias, verbenas, heliotropes, etc.; with roses and plants of a woody nature, however, the old plants usually do best. Dutch bulbs, such as hyacinths, tulips, crocus, etc., and most of the varieties of lilies, may be planted. Violets that are wanted for winter flowering will now be growing freely, and the runners should be trimmed off. Sow seeds of sweet alyssum, candytuft, daisies, mignonette, pansies, etc.

Fruit Garden.—Strawberry plants that have been layered in pots may yet be planted, or in southern districts the ordinary ground layers can be planted. The sooner in the month both are planted the better crop they will give next season; and, as these plants soon make runners, it will be necessary to trim them off. Attend to raspberries and blackberries as advised for last month, if they have not already been attended to.

Vegetable Garden.—If cabbage, cauliflower, and lettuce are wanted to plant in cold frames, the seed should be sown from about the tenth to the twentieth of this month; but judgment should be exercised, for, if sown too early, cabbage and cauliflower are apt to run to seed. The best date for latitude of New York is September 15th. The main crop of spinach or sprouts that is wanted for winter or spring use should be sown about the same date. The earth should be drawn up to the celery with a hoe preparatory to earthing up with a spade. Onions that were not harvested and dried last month must now be attended to. Turnips of the early or flat sorts may yet be sown the first week of this month in the Northern States, and in the South from two to four weeks later.

OCTOBER.

Flower Garden and Greenhouse.—In northern sections of the United States, tender plants that are still outside should be got under cover as early as possible. Delay using fire heat as long as possible, unless the nights become so cold as to chill the plants inside the house. Roses, carnations, camellias, azaleas, pelargoniums, and the hardier sorts of plants will do better if placed in a cold frame or pit until the middle of November than they would in an ordinary greenhouse. Look out for insects. Fall bulbs of all kinds may be planted. Take up summer-flowering bulbs and tubers, such as dahlias, tuberose, gladioli, cannas, caladiums, tigridias, and dry them off thoroughly, stowing them away afterward in some place free from frost and moisture during winter.

Fruit Garden.—Strawberries that have been grown from pot-grown layers may yet be planted in Southern States; keep the runners trimmed off. Fruit-trees and shrubs may be set out; but, if planting is deferred to the last of the month, the ground around the roots should be mulched to the thickness of three or four inches with straw, leaves, or rough manure, as a protection against frost.

Vegetable Garden.—Celery will now be in full growth, and will require close attention to earthing up, and during the last part of the month the first lot may be stored away in trenches for winter. All vegetable roots not designed to be left in the ground during the winter should be dug up, such as beets, carrots, parsnips, sweet potatoes, etc. The cabbage, cauliflower, and lettuce plants grown from seed sown last month should be pricked out in cold frames. If lettuce is wanted for winter use, it may now be planted in the greenhouse or cold

frame, and will be ready for use about Christmas. If asparagus or rhubarb is wanted for winter use, it should be taken up and stowed away in pit, frame, shed, or cellar for a month or two. It may then be taken into the greenhouse and packed closely together under the stage, and will be fit for use from January to March, according to the temperature of the house.

NOVEMBER.

Flower Garden and Greenhouse.—Plants intended to be grown inside should now all be indoors. Keep a sharp lookout for cold snaps, as they come very unexpectedly in November, and many plants are lost thereby. In cases where it is not convenient to use fire heat, 5° to 10° of cold can be resisted by covering the plants over with paper, and by using this before frost has struck the plants valuable collections may be saved. When fire heat is freely used, be careful to keep up the proper amount of moisture by sprinkling the paths with water. Little can be done in the flower garden, except to clean off all dead stalks, and straw up tender roses, vines, etc., and, wherever there is time, to dig up and rake the borders, as it will greatly facilitate spring work. Cover up all beds in which there are hyacinths, tulips, and other bulbs with a litter of leaves or straw to the depth of two or three inches. If short, thoroughly decayed manure can be spared, a good sprinkling spread over the lawn will help it to a finer growth next spring.

Fruit Garden.—Strawberry beds should be covered (in cold sections) with hay, straw, or leaf mulching, to a depth not exceeding two inches. Fruit-trees and grapevines generally should be pruned; and, if the wood of the vine is wanted for cuttings, or scions of fruit-trees for grafts, they should be tied in small bundles and buried in the ground until spring.

Vegetable Garden.—Celery that is to be stored for winter use should be put away before the end of the month in all sections north of Virginia; south of that it may be left in most places where grown throughout the winter if well covered up. The stalks of the asparagus bed should be cut off, and burned if there are berries on them, as the seeds scattered in the soil sometimes produce troublesome weeds. Mulch the beds with two or three inches of rough manure. All vegetable roots that are yet in the ground, and not designed to be left there over winter, must be dug up in this latitude before the middle of the month, or they may be frozen in. Cover up onions, spinach, sprouts, cabbage, or lettuce plants with a covering of two or three inches of leaves, hay, or straw, to protect them during the winter. Cabbages that have headed may usually be preserved against injury by frost until the middle of next month, by simply piling them up and packing them closely in a dry spot in the open field with the heads down and roots up. On approach of cold weather in December they should be covered up with leaves as high as the tops of the roots, or, if the soil is light, it may be thrown over them, if leaves are not convenient. Cabbages will keep this way until March if the covering has not been put on too early. Plow all empty ground if practicable, and, whenever time will permit, do trenching and subsoiling. Cabbage, cauliflower, and lettuce plants that are in frames should be regularly ventilated by lifting the sash on warm days, and on the approach of very cold weather they should be covered with straw mats or shutters. In the colder latitudes, and even in the Middle States, it is absolutely necessary to protect cauliflower in this way, as it is much more tender than cabbage and lettuce plants.

DECEMBER.

Flower Garden and Greenhouse.—Close attention must be paid to protecting all tender plants, for it is not uncommon to have the care of a whole year spoiled by one night's neglect. Vigilance and extra hot fires will have to be kept up when the thermometer falls to 34° or 35° in the parlor or conservatory. It is well to set the plants under the benches or on the walks of the greenhouse; if they are in the parlor move them away from the cold point and protect them with paper; this will usually save them even if the thermometer falls to 24° or 26°. Another plan in the greenhouse is to dash water on the pipes or flues, which causes steam to rise to the glass and freeze there, stopping up all the crevices. With plants outside that require strawing up or to be mulched, this will have now to be finished.

Fruit Garden.—In sections where it is an advantage to protect grapevines, raspberries, etc., from severe frost, these should be laid down as close to the ground as possible, and covered with leaves, straw, or hay, or with a few inches of soil.

Vegetable Garden.—Celery in trenches should receive the final covering for the winter, which is best done by leaves or light stable litter; in the latitude of New York it should not be less than twelve inches thick. Potatoes, beets, turnips, or other roots in pits, the spinach crop in the ground, or any other article in need of protection, should be attended to before the end of the month; manure and compost heaps should be forwarded as rapidly as possible, and turned and mixed so as to be in proper condition for spring. Remove the snow that accumulates on cold frames or other glass structures, particularly if the soil which the glass covers was not frozen before the snow fell; it may remain on the

sashes longer if the plants are frozen in, since they are dormant, and would not be injured if deprived of light for eight or ten days. If roots have been placed in cellars, attention must be given to ventilation, which can be done by making a wooden box, say six by eight inches, to run from the ceiling of the cellar to the eaves of the building above.

33. CULINARY HERBS.—Besides the esculent and salad plants, there are several minor herbs used for flavoring and garnishing. For the most part they are dwarf perennial plants requiring to be grown on a dry, warm soil in an open, sunny aspect, or annuals for which a warm sheltered border is the most suitable place; and they may therefore be conveniently grown together in the same compartment—an herb garden. The perennials should be transplanted either every year or every second year.

For winter use the tops of the most useful kinds of herbs should be cut when in flower or full leaf and quite dry, and spread out in an airy but shady place so as to part slowly with the moisture they contain, and at the same time retain their aromatic properties. When quite dry they should be put into dry, wide-mouthed bottles, and kept closely corked. In this way such herbs as basil, marjoram, mint, sage, savory, and thyme of the aromatic class, balm, chamomile, horehound, hyssop, and the rue of the medicinal class, as well as parsley, may be had throughout the season with almost the full flavor of the fresh herb.

Angelica, *Archangelica officinalis*.—A stout biennial umbellifer; sow in April, in deep rich soil. The stems and leaf-stalks are candied.

Anise, *Pimpinella Anisum*.—A slender umbelliferous annual; sow in May in light, warm soil; English summers are scarcely warm enough to bring it to perfection.

Balm, *Melissa officinalis*.—A hardy labiate perennial; divide the roots in October; dry for winter use.

Basil, *Ocimum Basilicum*.—A fragrant labiate annual; sow in a gentle heat in March, and plant out on a warm border; or sow in a warm sheltered place in April or May; or in winter sow in heat (65°–70°) in pots or boxes in rich, light soil, once a month from November onward; that sown in April or May should be cut when in blossom, and dried slowly for winter use.

Borage, *Borago officinalis*.—A stout native British annual, used for garnishing; sow in March and May in an open place, in good soil.

Burnet, *Poterium Sanguisorba*.—A hardy native perennial; divide the roots in October or February. It tastes like cucumber.

Caraway, *Carum Carui*.—A hardy umbelliferous biennial; sow in April or May to flower the following summer.

Chamomile, *Anthemis nobilis*.—A hardy native British composite perennial of prostrate habit; divide the plants in autumn or spring, planting in rather poor, dry soil; the flower-heads should be gathered successively as they open, and carefully dried and stored.

Chervil, *Anthriscus Cerefolium*.—A hardy annual umbellifer; sow in March, and again in October if required for spring use.

Coriander, *Coriandrum sativum*.—A hardy annual umbellifer; sow in March in light loamy soil.

Dill, *Anethum graveolens*.—A hardy annual umbellifer; sow in March on a warm border, in rich, light soil.

Fennel, *Foeniculum vulgare*.—A hardy perennial umbellifer; sow in March or divide the roots at the same season.

Finochio, *Foeniculum dulce*.—A somewhat tender kind of fennel, with two-ranked leaves, fleshy at the base, which part is blanched by earthing up like celery; sow in March and successively if required, in light, very rich soil.

Horehound, *Marrubium vulgare*.—A hardy native labiate perennial, best raised annually from seeds sown early in March, or by selecting self-sown autumn seedlings.

Hyssop, *Hyssopus officinalis*.—A hardy evergreen suffructose labiate plant; sow in March or April, young plants being more vigorous than older ones; it may also be divided in spring.

Lavender, *Lavandula vera*.—An aromatic undershrub of the labiate order, requiring a light, warm, dry soil, and increased by cuttings, or by slips taken off with roots about March or April.

Marigold, *Calendula officinalis*.—A hardy composite annual; sow in March, in any garden soil.

Marjoram, *Origanum Majorana*.—A tender labiate, usually treated as an annual, and known as Knotted Marjoram; sow in March in a slight heat, and plant out on a warm, sunny border. The *Pot Marjoram*, *Origanum Onites*, and *Winter Sweet Marjoram*, *Origanum heracleoticum*, are hardly perennials,

growing best in dry, warm soils; divide and transplant in autumn or spring; a winter supply is provided by cutting the stems, when the plant is in flower, and drying in an airy, shady place.

Mint, *Mentha viridis*.—A hardy native labiate perennial, often called Spearmint. The running underground roots should be taken up in February or March, and replanted in fresh, good soil. The young tops may be obtained early by forcing; the leafy stems may also be cut when at their full growth in summer, and dried for winter use. The *Peppermint*, *Mentha piperita*, is cultivated like the spearmint, only its runners grow above instead of beneath the ground, and require planting accordingly.

Parsley, *Petroselinum sativum*.—A hardy unbelliferous biennial; sow in February, again in May, and again in July to have a good supply, a portion of the last-sown crop being protected by frames or hand-lights, so as to be accessible in frosty weather; it likes a free soil of good quality, but not too richly manured.

Pennyroyal, *Mentha Pulegium*.—A hardy native labiate perennial, growing in moist situations, and best cultivated on a north border, is propagated freely enough by its running stems, which should be well established early in autumn.

Rosemary, *Rosmarinus officinalis*.—An evergreen undershrub of the labiate order, just tender enough to be killed in all but the most sheltered situations by the most severe British winters, but surviving uninjured through those of ordinary severity. It requires a light, dry soil and a sheltered situation, and is increased by cuttings or rooted slips taken off in spring.

Rue, *Ruta graveolens*.—A hardy evergreen rutaceous undershrub, which will grow freely in ordinary garden soil, and is propagated by cuttings or slips, or very freely by seeds, which ripen abundantly.

Sage, *Salvia officinalis*.—A hardy evergreen undershrub, belonging to the labiates, of which there are two varieties, the green-leaved and the red-leaved, the latter being somewhat the hardiest; it is increased by earthing up the outside stems, which after the lapse of a year may be taken off as rooted plants in the following April or May.

Savory, *Satureja hortensis*.—A hardy labiate annual; sow on a warm border in April; when the plants reach the flowering stage dry a portion for winter use. The *Winter Savory*, *Satureja montana*, a hardy evergreen undershrub, is propagated by cuttings taken off in April and May, or by dividing the plant about April.

Tansy, *Tanacetum vulgare*.—A hardy composite native perennial, which soon grows thick and exhausts the soil, and should therefore be divided and transplanted every second year. If required earlier than the natural season, a root or two may be potted and set in a mild forcing-house or hotbed.

Tarragon, *Artemisia Dracunculus*.—A hardy perennial composite plant, which grows freely in light, dryish soil, and is increased by division in October or March; it should be transplanted every year or two. Tarragon may be had during the winter by potting a root or two early in December, and placing them in heat.

Thyme, *Thymus vulgaris*.—A hardy evergreen undershrub, requiring a light, dry, warm soil, and an open but sheltered situation; it may be raised from seeds sown in April and thinned out; or the old roots may be divided about April. The tops should be cut in summer, and preserved for winter use in the same way as savory and marjoram. The *Lemon Thyme*, *Thymus citriodorus*, is of a more decumbent habit, and may be parted and transplanted in spring in genial weather during the month of April.

Wormwood, *Artemisia Absinthium*.—A hardy native composite perennial, which will grow in any soil, but is most aromatic on those which are dry and poor. The plants should be replaced annually in autumn, when self-sown plants are generally to be found round about the old ones; if not so produced, they can be provided by sowing the seeds during the summer.

HOSEA, the son of Beêrî, the first in order of the minor prophets. The name Hosea (הוֹשֵׁעַ, LXX.

’Ωσηέ, Vulg. *Osee*, and so our English version in Romans ix. 25) ought rather to be written Hoshea, and is identical with that borne by the last king of Ephraim, and by Joshua in Numbers. Of the life of Hosea we know nothing beyond what can be gathered from his prophecies. That he was a citizen of the northern kingdom appears from the whole tenor of the book, but most expressly from i. 2, where “the land,” the prophet’s land, is the realm of Israel, and vii. 5, where “our king” is the king of Samaria. The date at which Hosea flourished is given in the title, i. 1, by the reigning kings of Judah and Israel.

The first part of Hosea’s prophetic work, correspond-

ing to chapters i.-iii., lay in the years of external prosperity immediately preceding the catastrophe of the house of Jehu in or near the year 750. The second part of the book is a summary of prophetic teaching during the subsequent troublous reign of Menahem, and must have been completed before 734 B.C. Apart from the narrative in chapters i.-iii., to which we shall presently recur, the book throws little or no light on the details of Hosea's life. It appears from ix. 7, 8, that his prophetic work was greatly embarrassed by opposition, "As for the prophet, a fowler's snare is in all his ways, and enmity in the house of his God."

The most interesting problem of Hosea's history lies in the interpretation of the story of his married life, (chaps. i.-iii.) We read in these chapters that God's revelation to Hosea began when in accordance with a divine command he married a profligate wife Gomer, the daughter of Diblaim. Three children were born in this marriage, and received symbolical names, illustrative of the divine purpose toward Israel, which are expounded in chap. i. In chap. ii. the faithlessness of Israel to Jehovah, the long-suffering of God, the moral discipline of sorrow and tribulation by which He will yet bring back His erring people and betroth it to Himself forever in righteousness, love, and truth, are depicted under the figure of the relation of a husband to an erring spouse. The suggestion of this allegory lies in the prophet's marriage with Gomer, but the details are worked out quite independently, and under a rich multiplicity of figures derived from other sources. In the third chapter we return to the personal experience of the prophet. His faithless wife had at length left him and fallen, under circumstances which are not detailed, into a state of misery, from which Hosea, still following her with tender affection, and encouraged by a divine command, brought her back and restored her to his house, where he kept her in seclusion, and patiently watched over her for many days, yet not re-admitting her to the privileges of a wife.

HOSHANGÁBÁD, a British district in the chief commissionership of the Central Provinces of India. It is bounded north by the Narbadá (Nerbudda), which separates it from the territories of Bhopál, Sindhia, and Holkar; east by the Dudhi river, dividing it from Narsinghpur district; south by the districts of Western Berar, Betúl, and Chindwára; and west by Nimár. Hoshangábád may be described as a valley of varying breadth, extending for 150 miles between the Nerbudda and the Sátputra mountains. Area, 4,437 square miles.

HOSHANGABAD, the headquarters town of the above district, is situated on the south side of the Nerbudda. Population (1889), 15,863. It is supposed to have been founded by Hoshang Sháh, the second of the Ghorí kings of Málwá; but it remained an insignificant place till the Bhopál conquest about 1720, when a massive stone fort was constructed, with its base on the river, commanding the Bhopál road.

HOSIERY. Under this name is embraced a wide range of manufactured textiles, which are classed together more on account of their manner of fabrication than from similarity of application or use. The term, as is quite obvious, has its origin in hose or stockings; but although stockings continue to be one of the staples of hosiery, that department is only one of a very numerous and diversified range of applications of the entire industry, it having been officially stated that not fewer than 5,000 distinct articles are made in the trade. All kinds of hosiery proper are made by the process of knitting, and the industry has been principally to deal with the fabrication of knitted under-clothing.

The art of knitting is the youngest of all the important textile manufactures, and, compared with the oth-

ers, its origin is quite modern. No certain allusion to the art occurs before the beginning of the fifteenth century.

The peculiarity of knitting consists in the use of a single thread for the entire texture, and in the formation therewith of a singularly elastic, yet strong and firm looped web.

The process of hand-knitting is universally known, and the endless details of fancy stitches and loops, whereby ornamented work can be produced, do not come within the scope of hosiery proper. While a vast quantity of the best and most comfortable hosiery is made with implements so simple and inexpensive as four knitting wires or needles, the manufacturing industry is carried on with machinery of unsurpassed ingenuity and complexity. Moreover, domestic knitting machines, mostly of American origin, have of late years been introduced, and, although these can never be expected to attain the popular favor of the sewing-machine, yet they have been widely adopted.

In the year 1589 the stocking-frame, the machine which mechanically produces the looped stitch in hosiery, was invented by the Rev. William Lee, a graduate of Cambridge, and native of Woodborough, near Nottingham. The fundamental principle of the apparatus consists in the substitution of a separate hooked or barbed needle for the support and working of each loop, in place of the system whereby an indefinite number of loops are skewered on one or more wires or needles. The method on which the machine is worked will be easily comprehended by the aid of the accompanying diagram (fig.

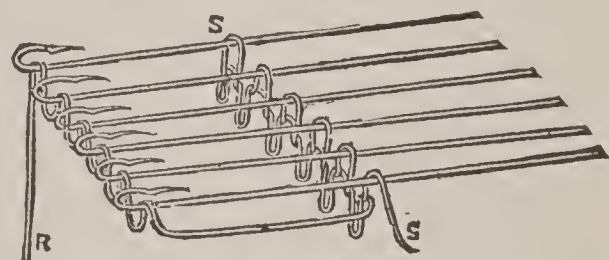


Fig. 1.

At R is seen a thread of yarn passed over the needle stalks; and within the terminal hooks. The yarn, it will be observed, is waved or depressed between each pair of needles, whereby sufficient yarn is secured to form the separate loops of uniform size, and thus produce a regular, equal fabric. The waving or depression of the yarn is produced by allowing thin plates of shaped metal, termed sinkers, to fall between each pair of needles after the yarn has been thrown across the whole range, and these sinkers, according to their depth of fall, carry down material for a large or small loop, as the case may be. The elastic points of the needle-hooks are next pressed into a groove in the stem by means of a presser bar, which acts on the whole row of barbs, and thus a range of temporarily closed metallic hooks is formed, through which the waved yarn is threaded. Over these hooks the loops of the already formed web SS have only to be drawn to form with the material R a new series of loops; the pressure is then relieved, and now R forms a new row in the work, in place of S, and the operation is ready to be repeated for a succeeding row. It is not necessary here to enter into a description of the various mechanical devices by which Lee perfected the complex movement of his stocking-frame. It is sufficient to say, that so perfectly did he succeed in his adaptations that to this day the essential features of his machine continue in use for the class of work to which he applied it. At first Lee was only able to work a flat, even web, which, when joined at the selvages, made an unshapen cylinder; but he soon learned to shape the work at pleasure by removing loops from time to

time from the outer edges of the web for narrowing or taking in, and to reverse that process for widening or letting out.

Neither Lee nor any of his relatives during their lifetime reaped an adequate reward for the great boon he conferred on mankind. His stocking-frame came gradually into extensive use, and an important industry was thereby created. No improvement of essential consequence was effected on the apparatus till in 1758 Mr. Jedediah Strutt, originally a Derbyshire farmer, adapted it to the production of ribbed work. Mr. Strutt's invention consisted of an addition to the original frame, which could be brought into use or not according as plain or ribbed work was desired. The addition consisted of a set of ribbing-needles placed at right angles to Lee's plain needles, and at the intervals required for producing ribbed courses. On the completion of a row of plain loops, the rib needles are raised; at their respective intervals they lay hold of the last-formed loop, and, bringing that through the loop which was on the rib needle itself before, they give an additional or double looping or twisting, which reverses the line of changing, and produces the ribbed appearance characteristic of this variety of work. For his invention Strutt in conjunction with his brother-in-law Woollet, a hosier, secured a patent, and they commenced the manufacture at Derby, where their "Derby-ribs" became exceedingly popular. The idea of adding parts to the plain frame of Lee, thus originated by Strutt, became the fertile source of a great number of the later adaptations and modifications of the apparatus. Strutt's invention was the starting-point of a great and most honorable business in the hands of himself and his family, and the elevation of his grandson, Lord Belper, to the peerage was a direct tribute to the industrial interests of the nation.

Down till almost the middle of this century only a flat web could be knitted in the machines in use, and for the finishing of stockings, etc., it was necessary to seam up the selvages of the web shaped on the frame (fashioned work), or to cut and seam them from even web (cut work). The introduction of any device by which seamless garments could be fabricated was obviously a great desideratum, and it is a singular fact that a machine capable of doing that in a perfect manner should have been patented in 1816, while it was not seen in actual use in Nottingham, the capital of the hosiery trade, till 1845. The inventor of the round stocking-frame was no other than Sir Marc I. Brunel, who in 1816 patented his machine under the name of the *Tricoteur*. In Brunel's apparatus the needles are fixed on the rim of a rotating wheel. The yarn is delivered, the loops formed, the beards of the needles pressed down, and all the other operations performed by means of a series of arms and wheels which act on the circumference of the ring or circle of needles. As the working of such a machine is continuous, and as several sets of wheels and arms may work simultaneously around a ring of sufficient diameter, Brunel's machine was really capable of doing work with very great rapidity. He appears not, however, to have regarded his invention as worthy of being pushed into notice, and it was not till 1845 that, in an improved form, it was brought forward as an original invention by Mr. Peter Claussen, who, however, reaped no profit from his undoubted ingenuity and merit.

Another improvement of very great importance in the hosiery trade was effected through the invention of the tumbler needle, patented by Mr. M. Townsend in 1858. The tumbler needle (fig. 2) consists of a stem somewhat bulged near the point. The bulged part contains a groove in which there is hinged a short pin.

The pin is so placed that, when turned to the hooked or curved point, its own point falls into a spoon-like indent, thus forming a smooth metal loop. When reversed the pin falls into the groove of the stem, making a smooth stalk. In this way, as will be clear from the figure, when the yarn is caught in the curved point of the needles, the already formed loops in being brought forward to pass off the needles carry forward the hinged pin and close the steel loop, over which they pass quite smoothly. The newly formed loop then pushes over the tumbler into its groove, and the hook is once more ready to seize the yarn as it passes along. The tumbler needle and the revolving frame together form the basis of the various domestic machines which are now in the market. In machines in which the tumbler needle is adopted the needles themselves move in grooves, each being carried forward in succession as the feed of yarn comes opposite its position.

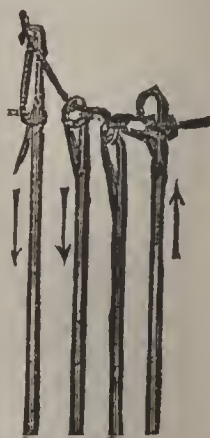


Fig. 2.

The varieties of frame now in use are embraced under narrow hand-machines, wide hand-machines, power rotary-frames, and power round-frames, the first two being exclusively used in the houses of the operatives, while the latter are factory machines driven by steam. "It will be an explanation of some interest," says the late Mr. Felkin, in a paper before the British Association (Nottingham meeting, 1866), "to those who are strangers to the process of these trades, to state that the hand-knitter of a stocking, if assiduous and clever, will knit 100 loops a minute, and that Lee on his first machine made 1,000 of worsted, and on his second 1,500 loops of silk per minute. The visitor may now see on the round frame, patented by Brunel in 1816, but since modified and improved, without any effort but to supply yarn, 250,000 loops of the finest textures made, in various colors, per minute, with safety—an advance of 2,500-fold upon the hand-knitter."

The principal center of the hosiery trade of the United Kingdom is Nottingham town and county; and in Leicestershire and Derbyshire the industry is also of importance. It was computed by Mr. Felkin that the English hosiery trade gave employment in 1866 to about 150,000 persons, of whom about 100,000 were occupied in the preliminary and finishing operations of winding, cutting, mending, seaming, etc. At that time the industry was largely domestic, frames being hired out to operatives; but the trade tends steadily toward factories. According to a parliamentary return issued July 31, 1879, there were in the United Kingdom 186 hosiery factories, giving employment to 14,992 persons, 6,683 males and 8,309 females. Of these, 175 factories were in England, 10 in Scotland, and 1 in Ireland; and centered in Nottingham, Leicester, Lincoln, Rutland and Derbyshire there were 173 of the establishments employing 13,680 of the operatives. The exports in 1878, which, of course, represent only a small proportion of the total output, amounted in value to £860,318. In the United States the industry is conducted on a manufacturing scale in New York State, Massachusetts, New Hampshire, Rhode Island, Vermont, Connecticut, and Maine; besides which family machines are extensively employed in this country. In Saxony also the trade is an important industrial feature, and there its development has been strikingly rapid. Throughout France, Spain, and Italy there are numerous frames at work, and indeed the trade may be regarded as in some degree commensurate with civilized industrial communities.

HOSIUS, or **OSIUS**, bishop of Cordova, the friend of Athanasius and the favorite of Constantine, was born about 256 A.D., most probably at Cordova, where he died in 359.

HOSPITAL is derived from the Latin *hospitalis* (adj.), and this again from the noun *hospes*, a host or guest. The place in which a guest was received was in Latin *hospitium* (hence the French, *hospice*), but in course of time the adjective became used as a noun, and the words *hospitalis*, *hospitale* and *hospitalia* were adopted in the same sense as *hospitium*, by dropping the nouns *domus*, *cubiculum*, or *cubicula*. In this sense Vitruvius uses *hospitalia* to mean the chambers where guests were received. The English word *hospital* (often reduced to *spital*) comes from the old French *hospital*, now *hôpital*, of which Littré says that it was remade from the Latin many centuries ago, although originally *hospitalis* had given rise quite regularly to *hostel*, now *hôtel*. The three words, *hôpital*, *hospice* and *hôtel*, although from the same source, are used now in very different meanings, the first being usually restricted to establishments for temporary occupation by the sick and hurt, for the purposes of medical and surgical treatment; the second (*hospice*) to places for permanent occupation by the poor, the infirm, the incurable, or the insane; and the last (*hôtel*) to dwellings, either public or private, for ordinary occupation. To the last, however, there is one exception, viz., when the term *hôtel-Dieu* (that is *hôtel de Dieu*) is applied to the chief hospital or infirmary of a town or city. In English we have no equivalent to *hospice*, so that the word *hospital* has been, and is still, used in the double sense, viz., as a place for medical treatment, and also as a retreat or almshouse for the poor, the infirm, etc. On the other hand the word *infirmary*, which originally meant a place or room set apart in an establishment (such as a monastery) for the reception of the sick members, and also for those who were through age or infirmity incapacitated from work, is not infrequently employed in the same sense as *hospital*, namely, as a separate establishment for the treatment of the sick.

Although in ancient times there may have been places for the reception of strangers and travelers, it seems at least doubtful if there was anything of the nature of a charitable institution for the reception of the sick, such as existed after the introduction of Christianity. The origin of our present hospital must be looked for in the monastic arrangements for the care of the sick and indigent. Every monastery had its *infirmaria*, managed by an *infirmarius*, in which not only were sick and convalescents treated, but also the aged, the blind, the weak, etc., were housed. In course of time separate buildings were erected for the purpose, and special revenues, augmented from time to time by benefactions, appropriated for their maintenance. In numerous instances, however, the hospitals were converted into benefices by the priests, and the scandal had to be dealt with by the authority of general councils, which, like that of Vienne, forbade the practice. About the earliest distinct record of the building of a hospital in England is in the life of Lanfranc, archbishop of Canterbury, who in 1080 founded two, one for leprosy and one for ordinary diseases. The former is referred to in the *Vie de St. Thomas le Martyr*, a work of the twelfth century. The establishments for the sick remained in the hands of the clergy until the Reformation, when some of the monasteries and church property were appropriated and set apart for the use of the sick.

Hospitals are usually divided into *General* and *Special*. In *General Hospitals* cases of all kinds are admitted some, while in others certain classes are excluded.

Special Hospitals are of various kinds, such as lying-in hospitals, ophthalmic, lock (for venereal diseases), cancer, consumption, etc., besides fever and small-pox hospitals. At the end of the last and beginning of this century, fever hospitals were generally called "houses of recovery," with a view of not alarming the people too much who had to resort to them. Special hospitals are also set apart for the treatment of diseases of children.

Besides the various civil hospitals there are also naval and military hospitals for the cure of sailors and soldiers.

Although hospitals have been intended as a blessing and benefit to the poor, they have too often proved the reverse, on account of the ignorance, on the part of their administrators, of the true principles of health. So much was this the case formerly that it has been not infrequently debated whether hospitals are or are not gigantic evils; and even where it is admitted that they are of value in cases of actual disease, it is still doubtful if they are really of benefit in cases of confinement. It may be of use to consider briefly the statistics of mortality at different times and in different places. It is very difficult to compare former death-rates with present or recent if we consider cases in bulk, because previous to the present century it was but little the custom to classify cases; so that a preponderance of surgical cases might exist at one period and of medical at another, with a corresponding variation of the death-rate. Of course in some exceptional instances we can point to remarkable differences due to known causes of unhealthiness. Thus in the Hôtel-Dieu of Paris, in the last century, a terrible mortality occurred, amounting to 1 in $4\frac{1}{2}$, or 220 per 1,000 (Tenon); and in the British hospitals at Scutari the mortality reached between 400 and 500 per 1,000. In both of those cases there was inordinate crowding, such as is hardly likely to be met with again. But in dealing with ordinary hospitals there are so many modifying causes that the comparison, without careful analysis, may be misleading. But it is when we examine the mortality of special cases that the most instructive lessons are to be learned; and the best for this purpose are surgical cases and lying-in cases. From these we gather that the mortality is pretty generally in the ratio of the size of the hospital and the consequent aggregation of patients, the crowding together of patients in the wards, the deficiency of ventilation, defective sewerage arrangements, and the want of constant attention to the details of cleanliness. Thus Sir James Simpson showed in his paper on "Hospitalism" the following statistics of mortality from amputations:

	Deaths per 1,000.
St. Bartholomew's.....	366
London Hospital, Whitechapel.....	473
Guy's.....	382
St. George's.....	388
Nine London hospitals.....	411
Royal Infirmary, Edinburgh.....	433
" " Glasgow.....	391
Eleven large and Metropolitan hospitals.....	410

On the other hand, amputations in country practice give a death-rate of only 108 per 1,000.

Comparing the results with the size of the hospital, that is, the aggregation of cases, we find:

	Deaths per 1,000.
Large Parisian hospitals, with more than 600 beds (Husson).....	620
English hospitals, 301 to 600 beds.....	410
" " 201 to 300 ".....	300
" " 101 to 200 ".....	230
" " 25 to 100 ".....	180
Cottage hospitals under 25 beds.....	140
Isolated rooms in country practice.....	108

The question of lying-in cases is even more remarkable. Doctor Lefort, having collected the statistics of

888,302 delivered in hospitals, and of 934,781 delivered at home, shows that in hospitals 35 per 1,000 die, and at home 4¾.

Doctor Steele gives the statistics of the four great lying-in hospitals of London, compared with the "extern-maternity" charities of Guy's, St. Bartholomew's, and St. Thomas':—

	Queen Charlotte's Lying-in.	British Lying-in.	General Lying-in.	City of London Lying-in.	Guy's.	St. Bartholomew's.	St. Thomas'.
Deaths per 1000..... }	2.82	15.7	14.8	13.5	4.1	3.1	3.5

Baron Meydell, chief of the sanitary department of St. Petersburg, has shown that in the largest lying-in hospital there, in which 2,000 women are confined in a year, the death-rate is from 30 to 40 per 1,000; in the second, in which about 1,000 women per annum are received, only 25 die; in the third, where 400 are received, only 20 die per 1,000; in the small detached asylums of two or three beds, of which there are eleven in different parts of the city, giving accommodation to 1,600 women per annum, or about 155 each, only 9 per 1,000 die; while among those confined in their own homes, including the poorest and most wretched, only 5 per 1,000 die. These numbers correspond with the observations above.

It can also be shown that outbreaks of disease are coincident with individual overcrowding, whether the hospital be large or small. Thus the terrible mortality of the Hôtel-Dieu of Paris in the last century was due as much to actual overcrowding as to the enormous aggregation of patients. The extraordinary spectacle was to be seen there of two or three small-pox patients, or several surgical cases, or sometimes even four parturient women lying in one bed. A large proportion of the beds were purposely made for four patients, and six were frequently crowded in.

The ill effects of overcrowding are seen in outbreaks of erysipelas, hospital gangrene, and surgical fever among surgical cases, and in puerperal fever in lying-in cases, while in all communicable diseases the danger of spreading is greatly intensified. It has been observed, that when only two or three women were in a ward, puerperal disease rarely showed itself, but that when five or six were put in, disease generally broke out.

Another great cause of mortality has been inefficient ventilation. If we can scatter our sick population and give them individually plenty of space in their wards, we shall have done much; but, if we do not also change the air sufficiently often we may still have evil results with all our care. Formerly no arrangements were made for ventilation in hospitals, schools, barracks, churches, or indeed in any buildings whatsoever. An immense deal remains to be desired in this direction still, but in recent hospitals, at least, more or less efficient means have been introduced, while efforts have been made to improve the conditions of the old. The want of fresh air aggravates all diseases, increases the power of infection, retards the convalescence, and hastens the death of patients; moreover, it lowers the tone of the healthy, and is the most potent of all agents in the propagation of phthisis or destructive lung disease.

Defective arrangements for the removal of excreta have constituted another cause of mortality. Water closets opening directly out of wards, and sinks, waste-pipes, bath-pipes, etc., in direct communication with the sewers, have been the means of introducing sewer poison

into hospitals, producing surgical and puerperal diseases, enteric fever, and diphtheria, and aggravating every other form of malady.

A want of constant attention to the details of cleanliness has been a fertile source of hospital disease. Dr. B. W. Richardson has traced out in a very instructive way the remarkable immunity of the Jews from epidemic and other diseases, and has shown that their religious attention to the details of the periodic cleansing enjoined by the Mosaic law appears to be the main cause of this notable circumstance. An instructive instance of the importance of this point is recorded by Mr. W. Cadge, surgeon of the Norwich Infirmary, which institution had long suffered from surgical diseases, such as erysipelas, pyæmia, and the like. These, it was supposed, were mainly due to the age and structural defects of the building, so that it was determined to pull it down and reconstruct it throughout. In the meantime a change of administration took place, and a new matron was introduced, who effected an entire alteration in the arrangements, and in particular insisted on an absolute and unremitting attention to every detail of cleanliness, both of building, clothing, bedding, and person. The result was an immediate cessation of the dreaded complications which had so vexed the hospital, and from that time there has been no return of them.

Faulty diet had also, doubtless, its influence on mortality, although its effects would be less easy to trace. One singular feature in the last century was the enormous allowance of beer given to patients in hospital, from two to three pints being common, and the allowance sometimes reaching half a gallon per diem. The absence of fresh vegetables from the diet, not only of hospitals but also of the populace at large, probably introduced a scorbutic taint which may have had some part in aggravating or modifying disease.

Some influence must also be allowed to the indiscriminate mixture of cases. The evil of this, especially in the more or less crowded state of the older hospitals, was recognized even in the last century, and was referred to by Tenon among others. Although the danger is materially lessened when ample space per bed is allowed, it is still unadvisable, not to say unfair, to place contagious cases with other patients. The argument has been advanced that by distributing infectious cases there is less danger of concentration of poison than when they are congregated together by themselves. With proper hygienic precautions, however, this concentration may be minimized, while the isolation of such cases gives the greatest immunity to others.

This question of concentration has been pushed still further, so as to bear against the existence of all hospitals whatsoever, and so far as lying-in hospitals are concerned we have seen that the objections are well founded. But when we consider the subject in its various aspects it must be admitted that it would be difficult to do without hospitals in some form or another. It would hardly be possible to afford people the same advantages of treatment, attendance, nursing, and comforts at their own homes, although in some cases the system of home treatment might be advantageously substituted, as has been done for so many years with so much success in Edinburgh and other towns of Scotland on the dispensary system. Another most important aspect of the question is the necessity for hospitals as places of instruction for those entering the profession of medicine. Although it would be wrong to subordinate in any serious way the claims of patients of any class to the requirements of teaching, it must yet be admitted that the only sound way of learning medicine and surgery is by clinical or bedside instruction, and we

may therefore reasonably demand that those who owe their treatment and care to public charity should be willing so far to contribute to the general welfare. Now it is clear that in dealing with large classes of students it would hardly be possible to convey proper clinical instruction except in a hospital. For this purpose the provincial hospitals ought to be more largely utilized, in addition to the metropolitan; at present the resources of the former are to a great extent wasted for teaching purposes.

Assuming then the necessity for hospitals, there still remains the question of the kind of hospital that should be constructed or approved of. It is certainly open to doubt whether we should continue to build monumental hospitals, and not rather construct slighter buildings, which may be destroyed and rebuilt from time to time, thus both scattering patients over a wider area and lessening the risk from long accumulation of infective material. This latter has been named the cottage or hut system of construction. The difficulties attending it are chiefly connected with original expense of site and with the current expenses of nursing and administration. On the other hand, it may be urged with some reason that with correct hygienic management there is no reason why a large hospital should not kept in a healthy condition.

Naval and Military Hospitals.—These are provided in all civilized countries for the care of the sailors and soldiers of the states. The two great English hospitals of Greenwich and Chelsea were founded as asylums for disabled and superannuated sailors and soldiers, but the former is now given up for that purpose, although a part is appropriated as a hospital for sick merchant seamen of all nations. The chief naval hospitals are those of Haslar, Plymouth, and Chatham. Haslar is the largest hospital in the country. The principal military hospitals are the Royal Victoria Hospital at Netley (the invaliding hospital of the army and the locality of the army medical school), the Herbert Hospital at Woolwich, the Cambridge Hospital at Aldershot, and numerous others at the principal stations.

In France there have long been hospitals established for the navy, such as those at Rochefort, Toulon, Brest, etc., as well as schools of instruction for medical officers. The chief military hospital is the Val de Grâce at Paris, formerly a convent; it is there that the medical school for the army is located. Large hospitals are also established in all the great stations. Great attention to military hospitals is also paid in Germany, Austria, and other countries of Europe. In most of them the administration is in the hands of the medical department, except in France, where the intendance still holds the reins, much to the disadvantage of efficiency and good working.

In the United States the army is small and chiefly employed on frontier duties, so that the hospitals are all what are called post hospitals, and as a rule are wooden huts or temporary structures, built to last ten years, and to hold twelve to twenty-four beds. There are, however, several permanent hospitals, among them being one for cadets at West Point, and another, the Barnes Hospital, at the Soldiers' Home near Washington. Upon inquiry Capt. C. A. H. McCauley, quartermaster of the Division of the Missouri, kindly informed us "that there were now no general military hospitals in the United States, but each military post has a hospital of its own. The largest posts are as follows: Forts Leavenworth, and Riley, Kan.; Omaha, Niobrara, and Robinson, Neb.; Yates, N. D.; Russell, Wyo.; Clark, Tex.; Wayne, Mich.; Wingate, N. M.; Douglas, Utah; Meade, S. D.; Keogh, Custer and Assiniboine, Mont.; Sill, I. T.; Grant, Ariz.; McPherson, Ga.; San Antonio,

Tex.; and Vancouver Barracks, Wash.; Presido, San Francisco, Cal." All the arrangements are under the army medical department. The navy and mercantile marine were long amalgamated in America, so far as hospital arrangements went. The Marine Hospital Service was formed in 1798, and the navy was not separated from it until 1811, although it was not for some years after that special naval hospitals were built. In connection with the marine hospital service, hospitals have been established at a great number of ports, both sea, river, and lake. Up to 1870 each of these hospitals had its own organization, but since that time a regular service has been established under a supervising surgeon-general. A tax of forty cents a month is levied for the service upon all seamen or members whatsoever of a ship's company. One of the finest hospitals is the Mercantile Marine Hospital at Chicago, a pavilion building of several stories, and of considerable architectural pretensions. But in America, as in Europe, the tendency has latterly been to abandon such monumental hospitals, and to construct single-storied pavilions on the hut or "barrack" principle, the word barrack being employed in this sense as equivalent to the French *baraque*, a wooden hut. Accordingly the new marine hospital at San Francisco has been thus constructed, three one-storied pavilions of California redwood radiating from the outside of a curved corridor, from the ends and inner center of which project the administrative blocks. The cost is about \$600 per bed, whereas the average cost of the older ones was fully seven times that amount, with the drawback that in course of time they became extremely unhealthy, and showed all the evils of hospitalism.

In America great attention has been paid to the question of hospitals, especially since its importance was so roughly thrust upon the country's notice in the great civil war of 1861-65. During that time numerous plans were tried, and among others the old plan of Petit, Poyet, etc., namely, radiating pavilions from a circular or oval center, which contained the offices and administration. This plan was found not to be a good one, as it interfered with both lighting and ventilation. The earliest American hospital of any size was the Pennsylvanian Hospital of Philadelphia, which was begun in 1755, under the auspices of Dr. Thomas Bond and Benjamin Franklin, and finished in 1805. It was also in Philadelphia that the first pavilion hospital of a permanent character was erected, the cornerstone being laid in 1860; in it the pavilions are parallel, two stories besides basement and attics. In New York there is a large amount of hospital accommodation. The Johns Hopkins Hospital at Baltimore will be memorable for the care bestowed upon the consideration of its plans. The one finally adopted is on the pavilion principle, scattered over a wide space of ground.

The hospitals of Chicago are numerous and well-appointed, the most notable among them being, Cook County Hospital, the Alexian Brothers' Hospital, Chicago Hospital for Women and Children, Hahnemann Hospital, Mercy Hospital, Michael Reese Hospital, Presbyterian Hospital, St. Luke's Hospital, Augustana Hospital, German Hospital, Bennett Hospital, Emergency Hospital, Chicago Floating Hospital, Homœopathic Hospital, Maurice Porter Memorial Hospital, National Temperance Hospital, St. Elizabeth's Hospital, St. Joseph's Hospital, Wesley Hospital, and Woman's Hospital of Chicago. Besides these there are two eye and ear infirmaries. Some of these are municipal institutions, some sustained by private beneficence, while others are denominational in their government. Various nationalities are also represented in the management of some of the above. Some are devoted to women en-

tirely, some to children, while others make no distinction as to sex. The medical attendance is excellent, and the best sanitary conditions prevail in the majority of instances.

HOSPITIUM. The power the Greeks possessed of traveling safely among other Greek states depended on the feeling which made hospitality a matter of religion, and looked on strangers as under the protection of Zeus Xenios. A stranger was received and protected during his stay. Violation of the duties of hospitality was likely to provoke the wrath of the gods; but it does not appear that anything beyond this religious sanction existed to guard the rights of a traveler. There is, however, no ground for the common statement that a stranger was *ipso facto* considered as an enemy.

HOST (Lat. *hostia*, "victim"), the name given in the Roman Catholic Church to the consecrated bread of the eucharist. It is so called in conformity with the doctrine of that church that the eucharist is a "sacrifice" in the strict sense of the word, though in the common language of Catholics, "host" is the use for the unconsecrated altar-bread, and even so occurs in the offertory of the Roman missal. The host in the Latin Church is a thin circular wafer (in Old English, "synging cake") of unleavened bread, made of the finest flour, and bearing stamped upon it the figure of the Crucifixion or some emblematic device, as the Lamb, or the letters IHS. These are the "points" and "figures" forbidden in the first book of Edward VI. In all ancient liturgical rites the consecrated host was broken before being consumed by the priest. In the Roman Church the celebrant, who uses at mass a larger host than that reserved for other communicants, first breaks it into two halves, and then from one half detaches a fragment which he drops into the chalice. In the Greek and other oriental churches, as well as in various Protestant communities, the eucharist is celebrated in leavened bread; and one of the grounds of separation from the West alleged by Michael Cerularius was the western practice of using unleavened bread. The use of unleavened bread is founded on the belief that Christ can only have used such bread when instituting the eucharist at the Paschal feast. Luther followed the Roman Church in this point, but did not break the host. It was decided by the Privy-council, in the Purchas case (1871), that the use of the wafer is forbidden in the Church of England. The elevation of the host is the act by which the priest immediately after pronouncing the words of consecration raises the host with both hands above his head, while the server tinkles his bell to call attention to the ceremony, that the congregation may adore Christ present.

HOSTAGE, a person given to an enemy as a pledge for the proper fulfillment of treaty conditions. Formerly the evasion of the terms of the treaty by one of the contracting parties used to be regarded as entitling the enemy to put to death the hostages that had been given up to them. The shooting of Archbishop Darboy and his fellow hostages in 1871 was the most execrable crime of the Paris Communists.

HOTCH-POT (or **HOTCH-POTCH**, **HODGE-PODGE**), in law, is the name given to a rule of equity whereby a person, interested along with others in a common fund, and having already received something in the same interest, is required to surrender what has been so acquired into the common fund, on pain of being excluded from the distribution.

HOTHO, **HEINRICH GUSTAV**, was born at Berlin in 1802, and died in his native city on Christmas day, 1873. He made a name for himself in Germany as a historian rather than as a critic of art.

HOTMAN, or **HOTTOMAN**, **FRANCOIS**, one of the most learned of French civilians, and a brilliant publicist, was born at Paris in 1524. He died at Basel in 1590. At Geneva Hotman was appointed professor of Roman law, and taught in peace for six years; in 1579, however, the threatening approach of the duke of Savoy frightened him away to Basel. Thence the plague sent him to Montbéliard in 1582, where he lost his faithful wife. After making trial of Geneva once more, he again fled to Basel. His principal work was the *Franco-Gallia*.

HOT SPRINGS, a town of Arkansas, in Garland county (about forty-five miles southwest of Little Rock) which takes its name from the thermal springs in the vicinity, and is much frequented by sufferers from chronic diseases. These springs, fifty-seven in number, range in temperature from 93° to 150°. They flow from the side of a mountain into a creek which joins the Washitaw river, about six miles from the town. They contain various carbonates and carbonic acid in solution, besides other constituents, and are held to be peculiarly efficacious (in conjunction with other medicinal and sanitary measures) in cases of blood diseases, such as secondary or tertiary syphilis and its sequelæ, rheumatism, neuralgia, etc. There are various methods of using these healing waters, from simple baths in them to using them in conjunction with liberal inunctions of mercury and other substances intended to have a depurating effect. Close by are chalybeate and sulphur springs which have a large patronage. The whole region about the town abounds in minerals of various kinds—the most prominent among them being a kind of oilstone useful as hones or whetstones on which to sharpen cutlery. The town has newspapers, churches, schools, etc., and a manufactory of oilstones, but its principal prosperity is dependent on the influx of visitors to the springs. It has railroad and telegraph connections, and banking facilities, and some trade with the surrounding country. Its hotel accommodations are good. The resident population was returned in 1890 (U. S. census) at 8,086.

HOTTENTOTS was the generic name given by Europeans to the native tribes inhabiting the southern extremity of Africa. These aborigines, totally distinct as they were in their primitive state from all other African races, have been generally regarded as the most ancient inhabitants of the land. When Sir John Barrow described their condition in 1798, he estimated their numbers at about 15,000 souls. In 1806 the official return gave a population of 9,784 males and 10,642 females. In 1824 they had increased to 31,000. At the census of 1865 they numbered 81,589, and the census of 1889 gave the Hottentot population within the Cape Colony at 90,000. In the returns for the last-mentioned periods, however, the designation "Hottentot" has no doubt embraced many persons of mixed race. The primitive character of the Hottentot or Khoi-Khoi has been greatly changed by their forced migrations, and their gradual adoption of the habits of civilized life. The best information as to their original manners and customs is therefore to be obtained from the descriptions given of them by the older writers, and especially that of Kolben, a German writer. All authorities agree in representing the natural disposition of the Hottentots as mild, placable, and ingenuous. Mutual affection was the greatest of their virtues. They held in contempt the man who could eat, drink, or smoke alone. They were hospitable to strangers; indeed, their munificence often left them scarcely anything for themselves. Another characteristic was indolence. While not deficient in talents or capacity, they seemed to lack the energy to call them-

into action. They did not, however, disdain to look after their cattle. Hunting they pursued for pleasure as well as sustenance, and when once aroused they were nimble and active, as well as bold and ardent. In personal appearance they were of a medium height, the females rather smaller than the men. Their bodies were slender but well proportioned, with small hands and feet. Their skin was of a leathery-brown color; their face oval, with prominent projecting cheekbones; eyes dark chestnut or black and wide apart; nose broad and thick and flat at the root; chin pointed, and mouth large, with thick, turned-up lips. Their woolly hair grew in short, thick, curly tufts on their head, and the beard very scanty. The women, especially as they advanced in years, had flabby breasts hanging down low; abnormal developments of fat were somewhat common among them; and cases occurred of extraordinary elongation of the *labia minora* and of the *præputium clitoridis*.

The dress of the men was very simple. A cloak or kaross, varying according to the fashion of the tribe, was usually thrown across the shoulders and a smaller one across the loins. Those of the chiefs or captains were usually of tiger or wildcat skins, those of the commonalty of sheep skins. They wore the cloaks all the year round, turning the hairy side inward in winter and outward in summer; they slept in them at night, and when they died they were interred in them. They had suspended around their necks little bags or pouches, containing their knives, their pipes and tobacco or daccha (*Cannabis*, or hemp), and an amulet of burnt wood. On their arms were rings of ivory. When they drove their herds to pasture they wore sandals on their feet, and some of them carried a jackal's tail fastened on a stick to wipe their face with when heated and drive away the flies. The women also wore karosses, a lesser under a greater, fashioned much like those of the men, but with the addition of a little apron, to which were appended their ornaments. In a leather bag suspended round their neck they carried daily, whether at home or abroad, some victuals, together with their daccha, tobacco, and pipe. They also wore an ornamented skin cap on their heads, armlets of iron or copper on their arms, strings of beads around their wrists, and around their legs thongs of oxhide sometimes covering half the leg or more.

They loved to besmear their bodies and their dress with greasy substances. The wealthy Hottentots were very lavish in the matter of butter and fat, the use of which was the grand distinction between rich and poor. They also perfumed themselves with the powdered leaves of a shrub called by them buchu (*Diosma crenata*). An ointment formed of soot and grease and the powder of buchu was held in very high estimation.

The sites of their villages or kraals were usually on green meadow grounds. They never entirely exhausted the grass or herbage, but kept moving at intervals from one spot to another. The huts or tents, which they could strike, carry, or pitch where they chose, were ranged in circles, the area of which varied with the pastoral wealth of the community. The small cattle were placed inside the circle, and the larger cattle outside. In the center of the huts a hole served for a fireplace, around which the members of the family were fond of squatting upon their haunches while they passed the tobacco pipe from one to another.

Their social pleasures consisted in feasting, smoking, dancing, and singing. Every signal event of life, and every change of abode and condition was celebrated with a feast.

Circumcision, which is common to the Kaffre tribes, was unknown to them, but when a youth entered upon

manhood a particular ceremony was performed. One of the elders or officiating priests, using a knife of sharp quartz, made incisions on the young man's body, and afterward besprinkled the same with urine.

The system of government was patriarchal. Each tribe had its hereditary "khu-khoi" or "gao-ao" or chief, and each kraal or encampment its captain. These met in council whenever any great matters affecting the privileges of the people had to be decided. They had no salary, but their persons were held in great reverence, and they were installed in office with solemnities and feasting. In certain tribes the hind part of every bullock which was slaughtered was sent to the chief, and this he distributed among the males of the village. He also collected sufficient milk at the door of his hut to deal out among the poor. A part of every animal taken in hunting was exacted by the chief, even though it was in a state of putrefaction when brought to him.

The captains assisted by the men of each kraal attended to the settlement of disputes regarding property and to the trial of criminals. A murderer was beaten or stoned to death; but if one escaped and was at large for a whole year, he was allowed to go unpunished. Adultery seldom occurred; if anyone found parties in the act and killed them he was no murderer, but on the contrary received praise for his deed. Women found offending were burned. Theft, especially cattle-stealing, was severely punished.

The religious ideas of the Hottentots were very obscure. Vaillant says they had "neither priests, nor temples, nor idols, nor ceremonials, nor any traces of the notion of a deity."

Various ceremonies were practiced to ward off the evil influence of ghosts and specters, and charms were freely employed. There was also a belief that in every fountain there was a snake, and that as long as the snake remained there water would continue to flow, but that if the snake was killed or left the fountain it would cease. Offerings were sometimes made to the spirit of the fountain.

HOTTINGER, JOHANN HEINRICH, a Swiss philologist and theologian, was born at Zurich, March 10, 1620. In 1667 he was drowned along with three of his children by the upsetting of a boat while crossing the River Limmath.

HOUBRAKEN, JACOBUS, Dutch engraver, was born at Dort, December 25, 1698. He died on November 14, 1780, having nearly completed his eighty-second year.

HOUDON, JEAN ANTOINE, was the most distinguished sculptor produced by France in the latter half of the eighteenth century. With Franklin, whose bust he had recently executed, Houdon left France for the United States in 1785, and, staying some time with Washington at Philadelphia, he modeled the bust, with which he decided to go back to Paris, there to complete the statue destined for the assembly hall of the State of Virginia. This statue, the execution of which is the principal interesting fact in the artist's life to Americans, now stands in the rotunda of the State capitol at Richmond, and represents Washington beside a plow, with his sword by his side. Houdon died at Paris in 1828.

HOUND. The foxhound, harrier and beagle are now the only representatives of whatever varieties of hounds existed previously in England. The staghound proper is practically extinct.

The modern foxhound is about as near perfection as he can well be, and his excellence is all the more wonderful that less than 200 years ago there does not seem to have been in existence any hound bearing a resemblance to him; for, until fox-hunting by hounds kept for

that especial purpose was instituted, there could have been no reason to breed foxhounds. According to old writers on hunting subjects, there appear to have been, among other varieties, the slow, plodding, southern English hound, with a great square head and wondrous powers of working on a scent, and the lighter northern hound; and as all animals improve under the care and guidance of man, until they assume the character of a distinct breed, it is clear that such has been the case with foxhounds, the earlier breeders of which did their part toward the attainment of perfection, by breeding with much care and judgment from the best specimens at their disposal. Older breeders were satisfied if the result of their crossings possessed good noses, and were up to the standard of beauty of those days; but the time came when pace had to be added to the list of foxhound virtues, owing to the use of better bred horses in the hunting field, and at the present day the development of pace without sacrificing nose is one of the greatest difficulties a breeder has to contend with.

Three years is quite early enough to begin to breed from any hound, male or female, and by that time it will be pretty well known what are the hunting capabilities of each. Out of every litter of whelps it may be necessary to destroy some—four or five are quite enough for a mother to rear—but a diversity of opinion exists among huntsmen as to which should be kept. As the points of a very young puppy cannot be seen, the selection is really one of color; some men prefer light colors, others dark; the majority are in favor of the latter, light-colored hounds and horses being popularly supposed to have weak constitutions and uncertain tempers.

When the puppies are three or four days old the dew-claws should be severed with a small and sharp pair of scissors, and after another day or two it is usual to cut off about an inch of the tail. Rounding is the last operation that foxhounds are subjected to, and generally takes place as soon as the puppy has quite recovered from the distemper; it consists in cutting off the ends of the ears so that they may not be torn in going through cover.

The feeding of a pack of hounds is a matter calling for the exercise of great care and judgment. Hounds' food comprises both animal and vegetable substances. Objections have sometimes been made to admitting the former into the kennel fare at all, on the ground that it is likely to impair the powers of scent, but the exception does not seem to be well-founded, because wild dogs, as also wolves and foxes, are carnivorous animals, and live by the use of their scenting powers; in moderation flesh is a necessity.

The harrier, like the foxhound, is a very different animal from what he was one hundred years ago. Then there were several sorts used in England in hare-hunting; first came the old southern hound, used principally in heavy countries; the second variety was a somewhat faster dog, with a sharp nose and pointed ears, and was best adapted for an open country; thirdly, a rougher-coated hound; and, lastly, the old-fashioned blue mottled harrier, found in the Weald of Sussex and some parts of Kent. The first and last of the above list are said to have been endowed with wonderful scenting powers, and we are told that, when these hounds were in use, a run of six hours after a hare was no uncommon occurrence; but they were so slow that the same authority tells us that they fatigued "the healthy foot-man very little."

HOUNSLOW, a township, formerly a market-town, in the parishes of Isleworth and Heston, county of Middlesex, Eng., is situated on the Great Western coach road, and on a branch of the London & Southwestern railway, nine miles from Hyde Park Corner. For many years the heath was a favorite resort for high

waymen, the carcasses of whom used to be exposed on gibbets along the road. According to an act passed in the fifty-third year of George III., the heath has been inclosed, and it is now nearly all cultivated. In 1793 large cavalry barracks were erected upon it, and it also affords a site for extensive powder-mills.

HOURL, a measure of time equal to $\frac{1}{24}$ th part of an astronomical day or to $\frac{1}{12}$ th part of a natural day (excluding the hours of night or darkness). *Hour-circles*, in astronomy, are any great circles which cut the poles.

HOURL-GLASS, an instrument for measuring intervals of time. It is made of glass and consists of two bulbs united by a narrow neck; one of the bulbs is nearly filled with dry sand, fine enough to run freely through the orifice in an hour, if the instrument is to be an hour-glass; in a minute, if a minute-glass, etc. The obvious defects of this instrument are the expansion or contraction of the orifice produced by heat or cold, and the variations in the dryness of the sand, all of which produce deviations from the true measurement of the time. The hour-glass was almost universally employed in churches during the sixteenth and seventeenth centuries. In several of the churches in England hour-glass stands of elegant workmanship are still to be seen.

HOURI, the name of the beautiful damsels who, according to the Moslem faith, await with their companionship in Paradise the true believers after death.

HOUSATONIC RIVER rises in Massachusetts, flows through Connecticut, and enters Long Island Sound near Bridgeport. In its course of nearly 150 miles it affords water to many manufacturing villages and towns.

HOUSE-FLY. This insect may be roughly described as a quarter of an inch long, black, hairy, with a reddish oval vertical spot and golden orbits, three gray longitudinal bands on the thorax, an interrupted yellowish band at the base of the abdomen, which has lateral and apical golden spots, and the base of the wings yellowish-white. But not only allied species are liable to be confused with the house-fly; representatives of other genera, such as *Anthomyia*, *Tachina*, and *Stomoxys*, are often mistaken for it, and a puncture from the sharp beak of the latter fly has often caused a wrong charge of blood-sucking to be brought against the subject of this notice, which has a short, fleshy bilobed tongue incapable of penetrating the skin, though provided with a terminal framework of tracheal tubes, acting like a rasp, by using which it often annoys us in the heat of summer. Linnæus, who first named the fly, left its transformations undescribed; De Geer in 1776, and Bouché in 1834, described the larva and pupa, and correctly defined their habitat; but it has been reserved for Dr. A. S. Packard, jr., the well-known American entomologist and biologist, to make a thorough investigation of their whole economy.

The minute dull chalky-white eggs (usually about 120 in number), elongate oval and cylindrical in shape, are laid by the parent fly in crevices of fresh manure in or about stables—heat, and especially moisture, being required for their development. The larvæ are hatched in twenty-four hours, and pass through three stages, averaging from five to seven days in all; in the second of its stages, the larva has been observed to increase by one-third of its length in twenty-four hours. They resemble those of the well-known meat fly, *Calliphora vomitoria*, but are smaller, longer, more slender, transparent, smooth, and shining, and regularly conical. The proleg at the apex is also much smaller, and cannot be seen from above when the larva is in motion. They eat the decaying parts of the manure, leaving the bits of hay and straw. The puparium, or pupa-case, is a quarter of

an inch long, cylindrical, and dark brown, closely resembling that of *Stomoxys calcitrans*, from which it chiefly differs in the larger and squarer anal spiracles and the smoother apex. The enclosed pupa is of the usual type of the cyclorhaphous *Diptera*, and is readily distinguishable from that of *Stomoxys* by its broad spatulate labium and curved maxillary palpi; it rests in the case with the hard framework of the jaws of the old larva skin next the ventral side, and when the fly pushes its way out, after remaining from five to seven days as a pupa, the upper end of the case splits off just behind the suture between the thorax and abdomen. The term "pupa" is here used in a general sense, since intermediate stages of development (variously called "pseudo-nymph" or "semi-pupa") in that condition occur in the *Muscidae*, as in *Hymenoptera*, *Coleoptera*, etc.

On leaving the pupa-case, the fly runs about with its wings soft, small, and baggy, pressed to the side of the body, much as in the pupa. It is pale, with the colors not set, and the membranous portion of its forehead constantly distends with air as the fly moves, being connected with the tracheæ. From Mr. Lowne's observations on the anatomy of the blow-fly, this organ is evidently employed for pushing away the end of the puparium when the pupa slips out of its case.

The whole period of evolution being thus from ten to fourteen days only, and the number of eggs laid by each female fly so numerous, it will be readily seen that any slight personal inconvenience to man, as produced by the habits of the perfect insect, are much more than compensated for by the unceasing labors of its larvæ as scavengers; the benefit being the more direct as the work is invariably done close to human habitations. The workings of the law of nature, by which an excess of increase in any one species is checked, are conspicuously shown in the case of this insect. Not only do the ordinary parasites of its own class (some Hymenopterous, and in one recorded instance Coleopterous) attack it in its earlier stages, but certain common birds are particularly addicted to it in the perfect state (in which also a *Chelifer*, a minute European representative of the scorpions, has also been found parasitically attached to it). The vegetable world also supplies some lethal agents in the shape of fungi (notably *Empusa muscæ*), individuals destroyed by which are constantly to be seen in autumn unable to move, and distended or ruptured by the expansion of the internal growth, the white spores of which are finally to be observed scattered around their victim.

Trivial as the house-fly may appear even to entomologists, it is to be noted that recent observations by the German biologist Weissman on its development have resulted in his discovery of his possessing "imaginal disks" in the early larval state—a structure deemed of sufficient value to suggest a new division of the whole *Insecta* into "Discota" and "Adiscota."

HOUSELEEK, *Sempervivum*, a genus of ornamental evergreen plants belonging to the natural order *Crassulaceæ*. About thirty species are known in gardens, some of which are hardy perennial herbs, and grow well in dry or rocky situations; the others are evergreen shrubs, or undershrubs, fit only for cultivation in the greenhouse or conservatory. The leaves are said to contain malic acid in considerable quantity, and are reckoned by herbalists to possess cooling and astringent properties. The leaves, freshly bruised, are applied to hæmorrhoids, boils, wens, and corns, and the expressed juice is used as a remedy for inflammation of the eyes and freckles, and especially for thrush (aphthæ) in children, also for stings and burns, erysipelas and herpes. Internally houseleek is used as a cooling remedy in dysentery and fluxes. The young leaves have also been eaten as salad, like *Portulaca*.

HOUSSA, HOUSA, HAUSSA, or HAUSA, an important people of the western Soudan, forming a main element in the population of the country between 12° and 13° N. latitude, from the Niger in the southwest to Bornu in the east. By Barth they are identified with the Atarantians of Herodotus; and it is certain that at a comparatively early date they attained great political power. The seven original states of Biram, Daura, Gobir, Kano, Rano, Katsena, and Zegzeg, formed a great confederation or empire, which extended its authority over many of the neighboring countries, and retained its preëminence till the beginning of the nineteenth century, when the Pullo (Fellata or Fulbe) rose upon its ruins.

The Houssa or Afnu language ranks as one of the richest and most cultivated in Africa; and it is not only the dominant vernacular throughout a large part of the Soudan, but serves as the means of communication in a great many places throughout the region to the south and west of the Lower Niger.

HOUSTON, a city of Texas, the third in point of population in the State, is located in Harris county, of which it is the capital. It is situated on Buffalo bayou, and has steamboat connection with Galveston. Houston has seven lines of railway connection, and is an important shipping point. It is forty-nine miles northwest of Galveston and one hundred and fifty-two miles south of Palestine. There are two daily and four weekly newspapers, two national and four other banks, cotton factories, machine shops, twelve churches, a convent, some fine public buildings, and considerable manufacturing. Among the principal products exported are cotton and corn. The assessed valuation (1890) is \$10,500,000, and the actual valuation of property is \$30,000,000. The population is 27,557. The receipts of the city treasury for 1889 were \$145,041.13, and the disbursements \$135,043.07. The total bonded debt is \$1,647,113.40 and the floating debt \$9,137.70. The school fund receipts were \$50,796.53, and the disbursements \$50,796.53.

Houston was named after Gen. Samuel Houston (1793–1862), who captured Santa Anna at San Jacinto, and who was president of Texas when it was an independent republic, and afterward its governor and United States senator. The city stands in a pleasant, undulating country, and its principal streets are well shaded and traversed by street railroads. Of late years, owing to the opening of through railway connection with New Orleans and Southern California, its commerce has greatly increased and its population more than doubled each decade.

HOUSTON, SAMUEL, an American general and statesman, was born near Lexington, Va., March 2, 1793. On the death of his father, a soldier of the revolution, in 1807, he removed with his mother to the frontier, and, settling in Blount county, Tenn., was soon on familiar terms with the Cherokee Indians. For a while he acted as a clerk to a trader, and then as village schoolmaster; but in 1813, after a residence of nearly three years among the Indians, he joined the United States army. He served with Jackson in the war against Great Britain, and at the peace of 1815 had risen from the ranks to a lieutenancy. Although conscious of his success, and proud of having won Jackson's friendship by his bravery, he then resigned his commission and turned to the study and practice of law at Nashville. In 1823 Tennessee returned him to Congress, and four years later he was elected governor of the State. He married in January, 1829, and in the April following, without assigning any reason, he suddenly abandoned his home and his office, and took up his residence among the Cherokees, by whom he was

formally adopted as a member of their nation. Returning to Washington, he successfully pleaded their cause against the government agents who had wronged them. In 1832 he settled in Texas, and was soon after elected a member of the convention called for the purpose of framing a constitution of that State, then in difficulties with the Mexican Government. On March 2, 1836, Texas declared its independence, and, on April 2d following, won it on the field of San Jacinto, where Houston, who had been appointed commander-in-chief of the Texas forces, with a body of 783 raw troops, defeated 1,600 Mexican veterans led by Santa Anna. On the recognition of the independence of Texas, Houston was elected president of the new republic, and re-elected in 1841; and, when Texas was admitted to the Union in 1845, he was returned as one of its two representatives to the senate. There he distinguished himself as a zealous friend of the Indians, opposing the Kansas and Nebraska bill in a memorable speech (March 3, 1854), and voting against the Lecompton constitution of Kansas. His decided opposition to secession obliged him in 1861 to retire from the office of governor of Texas, which he had held from 1859. He died at Huntsville, Tex., July 25, 1863. The hero of San Jacinto was above all things an able soldier, wary, intrepid, and resolute; but he also possessed as a legislator the qualities of rare foresight, cool discrimination, and fearless candor.

HOUWAERT, JEAN BAPTISTA (1533-1599), Flemish poet, was the most prominent of the rhetoricians of his day. He was born in 1533 and died in 1599.

HOVEDON, ROGER OF, an old English chronicler, was in all probability born at Howden, in the East Riding of Yorkshire, and was possibly a member of a family which had taken its name from the place. The date neither of his birth nor his death is known, and the first notice we have of him is as being sent in 1174 by Henry II., on whom he was in attendance in France, to endeavor to induce the lords of Galloway to withdraw from their allegiance to the king of Scotland.

HOWARD, HENRY. See SURREY, EARL OF.

HOWARD, JOHN, "the philanthropist," was born in 1726, most probably on September 2d, at Enfield, England. He was, in 1773, named high sheriff of Bedford, an office which, although as a Nonconformist he was unable to take the usual tests, he resolved to accept. The characteristic work of his life may be said to have now begun. When the assizes were held he did not content himself with sitting out the trials in open court; his inquisitiveness and his benevolence alike impelled him to visit the jail to which the prisoners had been condemned. Howard found it, like all the prisons of the time, wretchedly defective in all its arrangements, but what chiefly astonished and shocked him was an almost incredible abuse arising out of the circumstance that neither the jailer nor his subordinates were salaried officers, but were dependent for their livelihood on fees which they rigorously exacted from the prisoners themselves. He found it to be a fact that some whom the juries had declared not guilty, others in whom the grand jury had not found even such appearance of guilt as would warrant a trial, others whose prosecutors had failed to appear, were frequently detained in prison for months after they had ceased to be in the position of accused parties, until they should have paid the fees of jail delivery. His prompt application to the justices of the county for a salary to the jailer in lieu of his fees was met by a demand for a precedent for charging the county with such an expense. This he undertook to find if such a thing existed. He went accordingly from county to county until his journey had extended to every town in England which contained a prison, but the ob-

ject of his search eluded inquiry. He could find no precedent for charging the county with the wages of its servants, but he did find so many abuses in prison management which imagination had never conceived, and so many sufferings of which the general public knew nothing, and of which the law took no account, that he determined to devote to the exposure of those wrongs and the reform of those abuses whatever time and money might be needful. The task cost him a fortune, and the best remaining years of his life.

In April, 1775, he set out upon an extended tour through France, the Low Countries, and Germany. Returning to England in autumn with his copious notes, he determined, before finally reducing them to order and sending them to press, to undertake another tour of England. This lasted for seven months (November, 1775, to May, 1776) and yielded results so important by way of correction and supplement that he resolved to give his Continental experience the benefit of a similar revision. On this occasion he extended his tour to several of the Swiss cantons. At last in 1777 appeared *The State of the Prisons in England and Wales, with Preliminary Observations, and an Account of some Foreign Prisons* (Warrington). In 1780 he had published a quarto volume of 220 pages as an appendix (the first) to his *State of Prisons*, but on obtaining release from his employment at home his passion for accumulating statistics urged him to new and more extended Continental tours, as far as to Denmark, Sweden and Russia in 1781, and to Spain and Portugal in 1783. The results of these journeys were embodied in 1784 in a second appendix, with the publication of which his direct labors in connection with the subject of prison reform may be said to have ceased. The five remaining years of his life were chiefly devoted to researches on a different though cognate subject, that of the means which ought to be used for prevention of the plague, and for guarding against the propagation of contagious distempers in general. He died in 1790.

HOWE, JOHN, one of the greatest of the later Puritan divines, was born May 17, 1630, at Loughborough, Leicestershire, of which parish his father was minister. He died in London on April 2, 1706.

HOWE, RICHARD HOWE; EARL, English admiral, was born in 1725. In January, 1783, Howe succeeded Keppel as first lord of the admiralty, an office which he resigned in the following April, but again accepted under the Pitt ministry, holding it till July, 1788. In July, 1787, he was made admiral of the white, and shortly afterward was raised to an earldom. In 1790 he was appointed to the command of a fleet intended to operate against the Spaniards, but peace was concluded before any action took place. On the commencement of the war with France after the Revolution he obtained the chief command in the Channel, and on June 1, 1794, gained a great victory over the French fleet of Ushant, dismasting ten of the enemy's ships and taking seven, one of which, the *Vengeur*, sank as she was being towed away. On August 9th of the same year he resumed the command of the Channel fleet, but in none of his cruises was he fortunate enough to meet any of the enemy's vessels; and during the greater part of 1795 and 1796 ill health compelled him to remain on shore. In May, 1797, he resigned his command. In the same year he was appointed with full powers to treat with the mutineers in the British fleet at Portsmouth and Spithead, and completely succeeded, through the confidence they had in the friendliness of his intentions, and by the firm and judicious measures he adopted, in eradicating the causes of discontent. During the latter years of his life Lord Howe suffered much from ill health; and he died under a violent attack of gout, August 5, 1799.

HOWELL, JAMES (1594-1666), a voluminous English author, best known by his collection of letters (*Epistolæ Ho-Ëlianæ*) and his *Instructions for Forreine Travell*, which, in Mr. Arber's phrase, form our first handbook for the Continent. He died in 1666, having realized to the last his favorite motto, "*Senesco non segnesco.*"

HOWITT, WILLIAM, a popular writer and poet, was born in 1795 at Heanor, Derbyshire, where the Howitts had long been settled. A poem, published in 1814, on the *Influence of Nature and Poetry on National Spirit*, was, so far as we know, his first printed work. He married, in 1823, a Quaker lady, Mary Botham of Uttoxeter, who as poetess and prose-writer occupies a place in literature no less distinguished than her husband's. The first joint book appeared in the year of their marriage under the title, *The Forest Minstrel, and other Poems*. From this time to his death in 1879 the products of their joint authorship are too numerous to be given in detail, and comprise writings on a vast variety of subjects. He died at Rome on March 3, 1879.

HOWRAH, the largest and most important town in the district of Hooghly, Bengal, and the headquarters of the magisterial district of Howrah, is situated on the right bank of the Hooghly river, opposite Calcutta, and forms a suburb of that city. Population, 105,628.

HÖXTER, a town of Prussia, capital of a circle in the government district of Minden, province of Westphalia, is situated on the Weser at its confluence with the Grube and the Schelpe, and on a branch line of the Westphalian railway, two and one-half miles southwest of Holzminden.

HOYLE, EDMUND or EDMOND, the first systematizer of the laws of whist, and author of a book on games, was born in 1672. He died at Cavendish Square, London, August 29, 1769.

HRABANUS MAURUS MAGNENTIUS, archbishop of Mainz, and one of the most prominent teachers and writers of the Carolingian age, was born of noble parents at Mainz about the year 776. He died at Winkel on the Rhine, February 4, 856. He is frequently referred to as St. Rabanus, but incorrectly.

HROSVITHA, early mediæval dramatist and chronicler, occupies a very notable position in the history of modern European literature. Her endeavors formed part of the literary activity by which the age of the emperor Otto the Great sought to emulate that of Charles the Great. The famous nun of Gandersheim has occasionally been confounded with her namesake, a learned abbess of the same convent, who must have died at least half a century earlier. The younger Hrosvitha was born in all probability about the year 935; and if the statement be correct that she sang the praises of the three Ottos, she must have lived to near the close of the century. Some time before the year 959 she entered the Benedictine nunnery of Gandersheim, a foundation which was confined to ladies of German birth, and was highly favored by the Saxon dynasty. In 959 Gerberga, daughter of Duke Henry of Bavaria, and therefore niece of the emperor Otto I., was consecrated abbess of Gandersheim, and the earlier literary efforts of the youthful Hrosvitha (whose own connection with the royal family appears to be an unauthenticated tradition) were encouraged by the still more youthful abbess, and by a nun of the name of Richarda.

At the request of the abbess Gerberga, she composed her *Carmen de Gestis Oddonis*, an epic attempting in some degree to follow the great Roman model. It was completed by the year 968, and presented by the authoress to both the old emperor and his son (then already crowned as) Otto II. This poem so closely adheres to the materials supplied to the authoress by mem-

bers of the imperial family, that, notwithstanding its courtly omissions, it is regarded as an historical authority. Unfortunately, only half of it remains; the part treating of the period from 953 to 962 is lost, with the exception of a few fragments, and the period from 962 to 967 is summarized only.

HUANCAVELICA, or GUANCABELICA, the chief town of a department of same name, Peru, is situated in a deep ravine, of an average width of one mile, at about 12,400 feet above sea-level, and 160 miles southeast of Lima. Population, 4,000.

HUANUCO, or GUANUCO, the chief town of the Peruvian department of the same name, is situated on the left bank of the river Huallaga, near its junction with the Higuera, in a beautiful valley nearly 6,000 feet above sea-level, and 180 miles northwest of Lima.

HUARAZ, chief town of the Peruvian department of Ancachs, and of a district to which it gives its name, is situated on the left bank of the river Santa, in a fertile valley of the Andes, about 190 miles north-northwest of Lima.

HUBER, FRANÇOIS, an eminent Swiss naturalist, especially distinguished by the originality and reach of his researches into the life history of the honey-bee, was born at Geneva, July 2, 1750. From an early age François Huber displayed a dangerous ardor for study; and he was only fifteen years old when he began, in consequence of his ill-judged assiduity, to suffer from an affection of the eyes which gradually resulted in total blindness. Happily at once for his comfort and his fame he had secured the affection of Marie Aimée Lullin. Having patiently waited till she was legally of age, she married the husband of her choice, and ministered to his wants till her death with such unceasing devotion that it was only, he said, when he lost her that he really felt he was blind. For many years her efforts were seconded by François Burnens, a servant, whom Huber had inspired with something of his own love of nature. The results of the investigations which were conducted by this happily assorted trio at once surprised and delighted the world. So skillfully did the blind man devise his experiments, and so carefully did his assistants conduct and register their observations, that the work *Nouvelles Observations sur les abeilles* laid the foundation of all our scientific knowledge of the subject.

HUBER, JOHANN, a philosophical and theological writer, whose name is intimately connected in Germany, and indeed throughout Europe, with the Old Catholic and other recent movements toward freedom and enlightenment, was born in very humble circumstances, on August 18, 1830, at Munich. He died suddenly of heart disease at Munich on March 20, 1879.

HUBERT (HUGUBERT or HUGUBRECHT, "the Brightwitted"), St., bishop of Liège, was son of Bertrand, duke of Guienne, and held a prominent place in the court of the Frankish king Theodoric, and afterward in that of Pippin of Heristal. His death occurred in 727, and in 825 his remains were removed to a Benedictine cloister in the Ardennes, which thenceforth bore his name, and ultimately became a considerable resort of pilgrims.

HUBLI, a town in Dhárwár district, Bombay, situated thirteen miles southeast of Dháwár, on the main road from Poona to Harihar; it is 230 miles southeast from Poona, 142 miles from Bellári, ninety miles from Kárwár, and ninety-seven miles from Kumpta.

HUC, ÉVARISTE RÉGIS, a celebrated French missionary-traveler, was born at Toulouse, August 1, 1813. He died March 31, 1860.

HUCBALD was born in or about 840, if we may believe the statement of his biographers to the effect that he died in 930, aged 90. Of his life little is known;

not even the place of his birth can be ascertained, but he was no doubt a Frenchman or a Belgian. Between 883 and 900 Hucbald went on several missions of reforming and reconstructing various schools of music, including that of Rheims, but in the latter year he returned to St. Amand, where he remained to the day of his death (June 25, 930, or, according to other chroniclers, June 20, 932), and where his most important works on music were written.

HUCHTENBURG. Two brothers of this name practiced the art of painting in the second half of the seventeenth century. Both were natives of Haarlem. Jacob, the elder, of whom very little is known, studied under Berghem, and went early to Italy, where he died young about 1667.

John van Hutchenburg (1646–1733), born at Haarlem, it is said, in 1646, was first taught by Thomas Wyk, and afterward induced to visit the chief cities in Italy, where, penetrating as far as Rome, he met and dwelt with his brother Jacob. After the death of the latter he wandered homeward, taking Paris on his way. When he died in Amsterdam in 1733, Huchtenburg had done much by his pictures and prints to make Prince Eugene, King William, and Marlborough popular.

HUDDESFIELD, a municipal and parliamentary borough and market-town of England, in the West Riding of Yorkshire, is beautifully situated on the slope of a hill in the valley of the Colne, a tributary of the Calder, fifteen miles south of Bradford, and sixteen and one-half miles southwest of Leeds. Population, 96,000.

HUDSON, a city of the United States, capital of Columbia county, N. Y., is situated on the left bank of the Hudson river at the head of navigation, 114 miles north of New York city. The city is for the most part regularly built, with streets crossing each other at right angles. The city is well supplied with schools, and possesses three public libraries. Hudson at one time vied as a trading port with New York, and, although both its West India trade and its whale fishing have now been abandoned, it still carries on an important river trade, and has regular steam communication with New York and Albany. It also possesses large iron smelting works, a stove-foundry, a tannery, a flour-mill, breweries, iron-foundries, and factories for pianos, carriages, paper, car wheels and steam fire-engines. The population, which in 1870 was 8,615, was 8,619 in 1880, and 9,970 in 1890.

HUDSON RIVER, or NORTH RIVER, one of the largest and noblest rivers of the United States, and the principal river of the State of New York, is formed by the confluence of two small streams which rise in the Adirondack mountains in Essex county. About the middle of Warren county the river is joined by another of nearly equal size, the Schroon, which also has its rise in Essex county. After receiving the Sacondaga river ten miles further south, the Hudson flows irregularly in an easterly direction to Sandy Hill, after which it keeps a very straight course almost due south until it falls into New York Bay. At Troy it receives the Mohawk, whose volume of water is greater than its own, and at Kingston the Wallkill, but its other tributaries, though numerous, are unimportant. Its total length is about 300 miles, and the length of its course from Sandy Hill 190 miles. At Glen's Falls, near Sandy Hill, it makes a precipitous descent of fifty feet, whence there are various rapids of different velocities until it reaches Troy. It is tidal nearly up to Troy, and the fall from Albany, six miles below Troy, to the mouth of the river, a distance of 145 miles, is only five feet. By means of a lock and dam it is navigable to Waterford, a short distance above Troy, but largesteamers do not proceed further up than Hudson, twenty-nine miles below Albany, and 116

from the mouth of the river. A short distance below Albany the navigation has been obstructed by shifting sands, the point at which the difficulties are most formidable being the "overslaugh" at Castleton, but extensive operations have been for some time carried on in order to effect a permanent remedy for the obstructions. The breadth of the river at Albany is about 300 yards, and thence to Haverstraw, distant thirty four miles from New York, it varies from 300 to 900 yards. From Haverstraw to Piermont it expands into Tappan Bay, with a length of twelve miles and a breadth of from four to five, after which it narrows to a breadth of between one and two miles. The scenery of the river is for the most part varied and beautiful, generally picturesque, and in many places in the highest degree striking and magnificent. In the upper part the views, though not tame, are a little monotonous, the gently sloping hills, with the variegated colors of wood and cultivated land, and the occasional occurrence of a town or village, repeating one another without any marked feature to break their regularity. Below Troy, for a considerable distance, the number of islands renders much care in navigation necessary. Thirty miles from Troy noble views begin to be obtained of the Catskill mountains towering up on the west bank, the nearest eminence at the distance of about seven miles. Forty-six miles below Catskill is the large and flourishing city of Poughkeepsie, fourteen miles further down the prosperous city of Newburgh, a short distance below which, at the favorite summer resort of Cornwall Landing, the river enters the Highlands, passing between a series of hills whose frequently precipitous sides rise often abruptly from the water's edge. The views in this part of the river are of a character in some respects unparalleled, and at several points they have an impressiveness and surprising grandeur rarely equaled. The distance through which the river traverses this mountain scenery is about sixteen miles, and about ten miles after it is entered West Point is reached, a favorite landing place of tourists, the seat of the United States military academy, and historically interesting on account of Fort Putnam, now in ruins, built during the war of American independence, at which time a chain was stretched across the river to prevent the passage of British ships. After passing the pretty town of Peekskill the river widens into Haverstraw Bay, at the extremity of which is the headland of Croton Point. Below is the wider expanse of Tappan Bay, upon which stands Tarrytown, famous both historically and from its connection with Washington Irving, whose cottage of Sunnyside is in the vicinity. At Piermont, where the bay ends, the range named the Palisades rises picturesquely from the water to the height of 300 and 500 feet, extending along the west bank for about twenty miles, the left bank being level and dotted with hamlets and villas. At the mouth of the river on the west bank are Hoboken and Jersey City, and on the east bank New York city.

By the Erie canal the river is connected with Lake Erie, by the Champlain canal with Lake Champlain, and by the Delaware canal with the Delaware river; and its commercial importance as a means of traffic is not excelled by that of any other river in the world. It was on the Hudson that Fulton, the inventor of steam navigation, made his first successful experiment. The Hudson River Railway skirts the east bank of the river from New York to Troy, whence it bends eastward on its way to Lake Champlain. On the west bank a railway runs from Jersey City to Albany, and branch lines from various centers touch both banks at several points. The Hudson has some valuable fisheries, the principal fish being bass, shad and sturgeon. The attempts to stock it with salmon have not been very successful.

Though Verrazzani in 1524 proceeded up the river Hudson a short distance in a boat, the first to demonstrate its extent and importance was Henry Hudson, from whom it derives its name. He sailed above the mouth of the Mohawk in September, 1609.

HUDSON, GEORGE, the English "railway king," was born in York in 1800, was a successful linen draper in that city, and subsequently became the leading representative of the railway mania of 1845-46. Elected chairman of the North Midland Company, he was for three years the ruling spirit of speculation and as the arbiter of capital held the key of untold treasures. All classes delighted to honor him, and, as if a colossal fortune were an insufficient reward for his public services, the richest men in England presented him with a tribute of £20,000. Full of rewards and honors, he was suddenly ruined by the disclosure of the Eastern Railway frauds. His later life was chiefly spent on the Continent, where he benefited little by a display of unabated energy and enterprise. Some friends gave him a small annuity a short time before his death, which took place in London, December 14, 1871.

HUDSON, HENRY, a distinguished English navigator, of whose personal history before April 19, 1607, or after June 21, 1611, absolutely nothing is known, and whose well-earned fame rests entirely on four voyages which were all unsuccessful as regarded their immediate object, the discovery of a commercial passage to China other and shorter than that by the Cape of Good Hope. Of the first two voyages it is needless to speak, as they were barren of any particular result.

In the autumn of 1608 Hudson "had a call" to Amsterdam, where he saw Plancius, who gave him Waymouth's journals, and Hondius, who supplied him with translations of certain Dutch papers. After some vacillating negotiations he finally undertook for the Dutch East India Company his important third voyage to find the passage to China "by the east or the west." With a mixed crew of eighteen or twenty men he left the Texel in the *Half-Moon* on April 5th, and by May 5th was in the Barrentz Sea, and soon afterward among the ice near Costin Sareh in Nova Zemla, where he had been the year before. Some of his men becoming disheartened and mutinous (it is now supposed that he had arrived two or three months too early), he soon lost hope of effecting anything by that route, and submitted to his men, as alternate proposals, either to go to Lumley's Inlet and follow up Waymouth's light, or to make for North Virginia and seek the passage in about 40° latitude, according to the letter and map sent him by his friend, Capt. John Smith. The latter plan was adopted, and on May 14th Hudson set his face toward the Chesapeake and China. He touched at Stromo for water, and on June 15th off Newfoundland in about 48° latitude the *Half-Moon* "spent overboard her foremast." This accident compelled him to put into Sagadahoc (44° 1' latitude), where on July 18th a mast was procured, some communication with the Indians was had, and an unnecessary battle fought, in which the ship's two "stone murderers" were employed. Sailing again on July 25th, he was off Cape Cod on August 6th, and on the 9th (38° 39' latitude) "went with low sail because we were in an unknown sea." On August 18th they made Smith's Islands, six or seven miles north of the entrance to the Chesapeake. On August 28th, beginning the survey where Smith left off at 37° 36' according to his map, he coasted north to Sandy Hook, passing the "overfall" of the Delaware with scarcely any notice, probably because a western inlet there would have taken him in amid Smith's surveys. On September 3d, in 40° 30', he entered the fine bay now known by the name of New York. After having gone

150 miles up what is now the Hudson river, treating with the Indians, surveying the country, and trying the stream above tidewater, he became satisfied that this course did not lead to the South Sea or China, a conclusion in harmony with that of Champlain, who the same summer had been making his way south through Lake Champlain and Lake St. Sacrement to the South Sea. The two explorers by opposite routes approached within twenty leagues of each other. On October 4th the *Half-Moon* weighed for the Texel, and on November 7th put into Dartmouth, where she was seized by the English Government and the crew detained. The voyage had fallen short of Hudson's expectations, but it served many purposes perhaps as important to the world. Among other results it exploded Hakluyt's myth, which from the publication of Lok's map in 1582 to the third charter of Virginia in May, 1609, he had lost no opportunity of promulgating, that near 40° latitude there was a narrow isthmus, formed by the sea of Verrazano, like that of Tehuantepec or Panama.

Hudson's three failures served only to increase men's confidence in the existence of a passage by the northwest, for the discovery of which a new and strong joint-stock company was accordingly formed. The command was given to Hudson, who, on April 10, 1610, sailed in the *Discoverie* of seventy tons, the ship that took Waymouth in 1602 in the same direction. How he penetrated through the long straits, discovered the great bay that bears his name, at once his monument and his grave, how he and his men wintered in its southern extremity, how in coming north in the next summer, near the east coast, half way back to the straits, he, his son, and seven of his men, in a mutiny, were put into a shallop and cut adrift on Midsummer day, 1611, is told in many books. The ringleaders and half the crew perished miserably, but the *Discoverie* was finally brought home to London. No more tidings were received of Hudson, but no one doubted the complete success of his voyage. A grander company was incorporated in 1612, under Prince Henry, to complete the exploration of the passage, and to find the lost discoverer and his companions. Sir Thomas Butler was the commander in 1612, and the *Discoverie* was again the chosen ship. In 1613 the voyage was repeated by Gibbons, and once more in 1614 by Baffin; and the bay was thoroughly explored with the results which have long been universally familiar.

HUDSON'S BAY COMPANY is a joint-stock association formed for the purpose of importing into Great Britain the furs and skins which it obtains, chiefly by barter, from the Indians of British North America. The trading forts of the company are dotted over the immense region (excluding Canada Proper and Alaska) which is bounded east and west by the Atlantic and Pacific Oceans, and north and south by the Arctic Ocean and the United States. From these forts the furs are dispatched by boat or canoe to York Fort on Hudson's Bay, whence they are shipped to England to be sold by auction.

In the year 1670 Charles II. granted a charter to Prince Rupert and seventeen other noblemen and gentlemen, incorporating them as the "Governor and Company of Adventurers of England trading into Hudson's Bay." The first settlements in the country granted, which was to be known as Rupert's Land, were made on James' Bay and at Churchill and Hayes rivers; but it was long before there was any advance into the interior. Although the commercial success of the enterprise was from the first immense, great losses were inflicted on the company by the French, who sent several military expeditions against the forts. After the cession of Canada to Great Britain in 1763, numbers of fur-

traders spread over that country, and into the north-western parts of the continent, and began even to encroach on the Hudson's Bay Company's territories. These individual speculators finally combined into the North-West Fur Company of Montreal, of which Washington Irving has given an interesting description in his *Astoria*. The fierce competition which at once sprang up between the companies was marked by features which sufficiently demonstrate the advantages of a monopoly in commercial dealings with savages, even although it is the manifest interest of the monopolists to retard the advance of civilization toward their hunting grounds. The Indians were demoralized, body and soul, by the abundance of ardent spirits with which the rival traders sought to attract them to themselves; the supply of furs threatened soon to be exhausted by the indiscriminate slaughter, even during the breeding season, of both male and female animals; the worst passions of both whites and Indians were inflamed to their fiercest, and costly destruction of human life and property was the result. At last, in 1821, the companies, mutually exhausted, amalgamated, obtaining a license to hold for twenty-one years the monopoly of trade in the vast regions lying to the west and northwest of the older company's grant. In 1838 Hudson's Bay Company acquired the sole rights for itself, and obtained a new license, also for twenty-one years. On the expiry of this, it was not renewed, and since 1859 the district has been open to all, the Hudson's Bay Company having no special advantages beyond its tried and splendid organization. The licenses to trade did not of course affect the original possessions of the company. These it retained till 1869, when they were transferred to the British Government for £300,000 (\$1,500,000); in 1870 they were incorporated with the Dominion of Canada. The company, which now trades entirely as a private corporation, still retains one-twentieth of the entire grant, together with valuable blocks of land around the various forts; and these possessions will doubtless, as the country becomes opened up and colonized, yield a considerable revenue at some future time.

HUÉ, or HUE-FOO, the capital of the kingdom of Anam, is situated in a province of its own name, on the left bank of the Truong-Tiên or Hué river, which falls into the Chinese sea about eight miles further down. Population, 30,000.

HUELVA, one of the eight provinces into which Andalucia has since 1833 been divided, is bounded on the north by Badajoz, on the east by Seville, on the south and southwest by the Atlantic, and on the west by Portugal, and has an area of 3,913 square miles. With the exception of its southeast angle, where the province merges into the flat waste lands known as Las Marismas of the Guadalquivir, Huelva presents throughout its entire extent an agreeably varied surface, being traversed in a southwesterly direction by the western spurs of the Sierra Morena. Pop., 254,831.

HUELVA, the capital of the above province, is situated on the western shore of the triangular peninsula formed by the estuaries of the Odiel and Tinto, fifty-three miles west-by-south of Seville. Population, 18,915.

HUESCA, one of the three provinces into which the old northern Spanish kingdom of Aragon was divided in 1833, is bounded on the north by France, east by Lerida, south and southwest by Saragossa, and west and northwest by Navarre. The total area is 5,848 square miles. The surface is mountainous, especially in the north, which is occupied by the lofty offshoots of the Pyrenees, which there reach, in Monte Perdido, the height of 11,430 feet. Population, 254,958.

HUESCA, chief town of the above province, and the seat of a bishop, is pleasantly situated on an eminence

commanding an extensive view over the surrounding fertile plain. Population, 13,043.

HUESCAR, chief town of a judicial district in the Spanish province of Almeria, is situated in a plain, surrounded by mountains on three sides, about ninety-one miles northeast of Granada. Population, 7,760.

HUET, PIERRE DANIEL (1630-1721), bishop of Avranches, is the last of those encyclopædic and massive scholars of whom France produced so many. He left no successor to his omnivorous learning, prodigious memory, and indomitable energy. It was at the age of forty-six that he took orders, a step which he had contemplated for some years. Two years later the king gave him the abbey of Aunay, where he wrote his *Questions d'Aunay, sur l'accord de la Foi et de la Raison*, his *Critique de la Philosophie de Descartes*, his *Memoires pour servir à l'Histoire du Cartésianisme*, his dissertation on the site of the terrestrial paradise, and his discussion with Boileau on the Sublime. At length he retired to the Jesuits' House in the Rue Saint Antoine at Paris, where he ended his days, in 1721.

HUFELAND, CHRISTOPH WILHELM, a distinguished physician and writer on medical subjects, was born at Langensalza, August 12, 1762. He died at Berlin in 1836.

HUFELAND, GOTTLIEB, a distinguished writer on political economy and law, was born at Dantzic on October 19, 1760. At Halle he died in February, 1817.

HUG, JOHANN LEONHARD, Roman Catholic theologian and Biblical critic, was born at Constance, where his father was a locksmith, on June 1, 1765. He was seized with a painful illness, in 1845, which proved fatal on March 11th of the following year.

HUGH, ST., OF AVALON (c. 1135-1200), bishop of Lincoln, was born of a noble family at Avalon, near Pontcharra in Burgundy, about 1135. He died at London, on November 16, 1200.

HUGH OF ST. CHER, Hugo (Ugo) de S. Caro or Carensis, a learned compiler of the thirteenth century, was born at St. Cher, a suburb of Vienne, Dauphiné, about the year 1200. He died at Orvieto in 1263.

HUGH OF ST. VICTOR, Hugo a S. Victore, sometimes also known as Hugh of Paris, was born probably in the neighborhood of Ypres, about 1097. He died in 1141.

HUGUENOTS, THE. The word Huguenot first appears in France about the middle of the sixteenth century, and there is historical proof that it was imported from Geneva, where it had existed for some time as a political nickname in a form which connects it directly with the German-Swiss *Fidgenossen*, oath-comrades, confederates. In France it was used as a term of reproach for those who aimed at a reform of religion according to the pattern displayed by Calvin in his famous *Institutio Christianæ Religionis*. The name attached itself to the Reformers when, having shaken off all connection with Lutheranism, they were beginning to organize themselves both as a church and as a political body. The Lutheran ideas, which had early come into northern France by way of Metz and Meaux, had for a short time seemed likely to prevail at the court of Francis I., where the king's love of culture welcomed whatever came from the land of the learned; the genius of Erasmus, or the sharp satire of Hutten, or Luther's weighty tractates, all seemed to him at first to be so many protests against the darkness of a monkish past; the hymns of Marot, the bright poetry of Margaret of Valois, the king's sister, harmonized not ill with the desire for a humanist reform which prevailed at the French court. But when the destructive enthusiasm of the artisans who embraced the new opinions, breaking out in attacks on the art-treasures of the churches,

alienated the royal moderates, the simpler and more marked theology of the "Sacramentarians" of Geneva quietly replaced the Lutheranism of the first Reformers; and by the middle of the sixteenth century the new Huguenots were an unpopular party, drawing their inspiration from Calvin, and bitterly disliked by the court and the bulk of the people of France. The persecutions, varied by protection, of the reign of Francis I. had given place to a vehement desire to crush the rising heresy; the character of Henry II. and his chief advisers led them toward a thorough persecution.

Influenced by these repressive measures, and taught by Calvin's book and his frequent letters, the French Reformers now began to organize their infant churches. Hitherto they had been content to meet in quiet, to sing Marot's psalms, to listen to earnest prayer and practical discourse in some lowly chamber, deferring questions as to church government; now their ecclesiastical system began to develop itself. In 1555 the first Protestant French church was established at Paris, and almost immediately there sprang up fifteen communities, the largest being at Meaux, Poitiers, and Angers, each having its pastor, elders, and deacons, each ruling itself, and recognizing no common bond of union save that of charity and suffering. These were the heroic days of the Huguenot movement in France, each little church striving only to fulfill the simplest ideal of Christian faith and practice, happiest when least observed, purest when least developed. Three influences had hitherto acted on French religious feeling—that of the Lutherans, that of the ancient Vaudois churches of southeastern France, represented by Faber, and lastly that of Calvin of Noyon, the Picard exile settled at Geneva. Now a fourth element came in; resistance had elicited organization, organization demanded leadership; and, unhappily for France and the Huguenots, the movement fell too much into the hands of secular chiefs, great lords who used it for their own political and selfish purposes.

In 1559 the churches of the Huguenots met in a first synod at Paris, eleven sending representatives. This body drew up a confession of faith, which bears throughout the mark of Calvin's hand, in its scrupulous orthodoxy, strong statements as to God's election of some to eternal life, and careful definitions of the nature and structure of the church; the synod also issued a scheme of discipline to which the churches were all to conform. No church should take lordship over any other (a church being a single community under one pastor). Each "colloque" or synod should have a freely-elected president; every pastor should come to the colloque, bringing each at least one elder or deacon from his church; this body was to meet at least twice a year; new pastors were to be appointed by it to vacant churches, on presentation by the elders and deacons; minute rules were laid down for church discipline; it was ordered that provincial synods should be held in each province, and finally that there should be from time to time a general or national synod of representatives of the whole body.

Two years later the civil war broke out (see FRANCE), and lasted over thirty years. At the beginning of this period we have some data as to the Huguenot strength: Beza tells us that in 1558 there were 400,000 of them; a list presented by Condé to Catherine de' Medici is said to have contained the names of 2,150 (some say 2,500) churches; and it is probable that the number of their open adherents had increased rapidly. John Correro, Venetian envoy in 1569, says that only one-thirtieth of the common folk, but one-third of the nobles, were Huguenots, for the strength of the movement had undoubtedly come to lie in the noblesse. The

list of the Huguenot churches given by Haag provides us with data as to their distribution in France. The two centers were Languedoc in the south, and the Orléanais in the middle of the country; and a line drawn northwest to southeast through a point half way between Paris and Orleans would nearly give the northern limit of Huguenot success. Normandy, thanks to the Châtillon influence, had many churches; in Orleans and Burgundy they were well represented. In Guyenne and throughout western France they had numerous communities. The little independent principality of Béarn, through the influence of Jeanne d'Albret, Henry IV.'s mother, was entirely Huguenot. On the other hand, though there were some churches in the Île de France and Champagne, they had little hold there; and Picardy was from the first profoundly hostile to them, while Paris became the headquarters of the Catholic League. Their churches sprang up with wonderful quickness at this time; thus we see that all the seventy-six congregations in Languedoc named by Haag were established between 1558 and 1562. All were characterized by a like aptitude for organization; their constitution, simple and popular, is a proof that under better auspices the French people might have well exercised the privileges of constitutional liberty; the Huguenots had a popular representation and frequent deliberative assemblies. Between 1559 and 1598 they held fifteen general church synods, and from 1573 to 1622 many political assemblies, in which all questions bearing on the interests of the "cause" were debated and decided.

The subordination of the religious to the political interests of the Huguenots became inevitable after the massacre of St. Bartholomew's day, 1572; while at the same time their organization assumed a more decidedly republican tone. The horror they felt at the violent action of Charles IX. seemed to free them from all allegiance to him; they looked to England and Germany for help, to Switzerland and the United Provinces for encouragement and political example. They at once drew up an independent constitution, democratic and federative, framed chiefly after the Swiss pattern. Like all other attempts at a republican form of government, it had an aristocratic and a democratic side, the latter for the time seeming to be the stronger. For the center of their power was now passing from the aristocracy to the burghers, from country chateaux to provincial towns. In the towns the only distinction recognized was that of pastor and elders, and these might be, and mostly were, men of the people, chosen by the people. The great nobles who sided with them, the "Politique" princes like Alençon or Damville-Montmorency, winked for a time at this new "state within the state," the germ of that Huguenot organization which later on hampered Richelieu's path. Their system was based on the towns in their hands. In each an independent government was elected by popular suffrage, and was composed of a mayor, a council of twenty-four, and an elective chamber of seventy-five citizens, making up in all a hundred rulers. This body was a court of justice, with some amount of sovereignty. Thus, the twenty-four with the mayor had control over war, police, and "things of highest importance," though without the seventy-five they could neither pass nor abrogate laws, as to coin, taxation, truces, or terms of peace. The mayors and privy councils of the confederate towns were charged with the election of a general, a kind of Roman dictator, who was to have both a council to advise him and also five lieutenants to help and succeed him, if need were. Lastly, provision was made for a strict moral discipline.

Soon after this the Huguenots established a system of "generalities" or districts, each with its own local

estates, and over these provincial councils and a states-general, thus materially strengthening their independent organization. This system continued throughout the league wars (1574-1589), during which the religious movement was controlled by a knot of selfish political leaders, and in the course of which their point of view completely changed: for, while in the beginning they had passionately called for popular institutions and the convocation of the states-general of France, in the end they became the followers of Henry of Navarre, as heir to the French crown, representative throughout of the anti-popular temper of the Bourbon house. Under him the discontented Huguenots again reorganized themselves into nine great circles, over each of which was a council of from five to seven members, elected by delegates from the churches, and having the duty of laying their independent taxation, of levying, commanding, and paying their own troops. There was also a general assembly for all the circles (after the pattern of the United Provinces) sitting in three estates—pastors, nobles, burghers; the whole polity being representative as an aristocratic republic. This general assembly sat frequently, sent embassies to foreign powers, sometimes acting as an independent body politic.

The discontent of the Huguenots at last extorted from Henry IV. the famous edict of Nantes (May 2, 1598), a document which in the main only reproduced the more favorable of the earlier edicts. Its provisions were at least as helpful for Catholics as for Protestants; it was always being so modified as to show less and less favor to the Calvinists, who were little satisfied with it. They had dreamed of dominance, had hoped for equality, and were now put off with tolerance. For whatever Henry IV. might feel about their faith, he was determined, as he once told Sully, "to reduce to nothing the Huguenot faction," to destroy their political independence, and by closing up the civil strife to secure the solid establishment of the central monarchy. The edict allowed public exercise of the Huguenot faith in the houses of nobles and gentry, and in a few named towns; it gave the sectaries full civil rights, and made them eligible to all civil offices; in several parliaments mixed chambers were established; the education of their children was left in their own hands.

We find that about 1590 the Huguenots had exercise of their worship in about 3,500 chateaux, and in about 200 towns or bourgs, chiefly in the south and west. In most parts of the north, except Paris and around Rouen and Amiens, they had one place for worship in each bailiage or sénéchaussée. In 1598 existed a list of about 150 places granted by Henry IV. to the Huguenots for their safety, the chief groups being in the generalities of Bordeaux and Montpellier, and in Poitou; these were either free towns, like La Rochelle, Nîmes, Montauban, or towns belonging to private gentlemen, or towns belonging to the king, which had fallen into Huguenot hands during the wars.

Throughout the next quarter of a century we trace their history in a series of outbursts, indicating noble impatience and Calvinistic dissatisfaction. The siege and fall of La Rochelle (1627-1628) brought this period to an end. During this time their number seems to have increased; at the accession of Louis XIII. they had about 500 churches; in 1622 and 1628 we have lists of 688; in 1637 no less than 720 are enumerated, though of these forty-nine were either vacant or suspended. Richelieu and Mazarin treated them with statesmanlike prudence; their synods were discouraged, their grumblings ceased; they grew in piety and purity as the political arena was closed to them, and the noble houses one by one deserted them. This was the time of their material prosperity, and of their important contribution

to the welfare of France, which Louis XIV. so rudely cast away.

As that king got hold of his power, the tranquillity of the Huguenots waned. In 1657 they were forbidden to hold colloquies, lest perchance they should take to politics; in 1659 they were practically told to hold no more synods. Soon the court went further: conversions were undertaken. Wherever a pastor could be bribed, won over, or got rid of, his "temple" was at once torn down; the Huguenot worship became almost impossible in towns, and lingered on in a few castles, whereby it fell still more under the royal displeasure. As his conscience grew morbid, under Madame de Maintenon's direction, Louis XIV. became more eager to expiate his own crimes by punishing the heretics. Between 1657 and 1685 520 churches were rooted up; Anquetil declares that 700 had been destroyed before 1685. All through this period, while thousands yielded to oppression or bribery, thousands also fled the land; the emigration began in 1666 and went on for fifty years. It is probable that in 1660 there were over 2,000,000 of Huguenots, the best and thriftiest citizens in the land; it is said, though no figures can be trusted, that in all fully a million of French subjects escaped from their inhospitable fatherland. At last in 1685, thinking that the Huguenots were as good as suppressed, Louis XIV. revoked the edict of Nantes. The revocation was the sentence of civil death on all Huguenots; it crushed more than half the commercial and manufacturing industry of the kingdom. It is said that at the time of it there were 1,000 Huguenot pastors; of these over 600 escaped from France, 100 were slain or sent to the galleys, the remainder conformed or disappeared.

The war of 1689 called attention away from the persecuted remnant of the Huguenots, and they had a breathing space in Languedoc, the Cevennes, and Dauphiné; but directly the peace of Ryswick was signed, repression began again, and consequently, when the Spanish succession war commenced, the Huguenots of the "Desert," that is, of the country about Nîmes, broke out after endless provocations into open war, which lasted two years, and for a while defied all the efforts of the court. Marshal Villars was at last sent down, and by mingled gentleness and severity he both secured the submission of the gallant Cavalier, the chief leader of the Huguenots, and the defeat of the more determined of the mountaineers. Throughout the rest of the century the down-trodden Protestantism of France was kept alive chiefly by the exertions of Antoine Court, the apostle of the Desert, who never lost faith in the cause, and who reorganized the dying churches, breathing into them fresh life. Though under the influence of oppression and excitement, the Huguenot story is here and there disfigured by fanatical outbursts of the "prophets" and "prophetesses," still on the whole the account of their endurance is among the most remarkable and heroic records of religious history.

After the interference of Voltaire in behalf of Calas, their sufferings came almost to an end; the general change of opinion, the steady weakening of the Catholics, the indolence or good nature of the sovereign, forbade the scandals of the past, until at last in 1787, under Necker's influence, Louis XVI. signed a memorable edict which restored, after 102 years' deprivation, their civil status to the Huguenots. The Revolution of 1789 carried justice a stage further; among the many titles of the Revolution to the gratitude of posterity none is more marked than the complete restoration of the non-Catholic elements of French society to their rights. From that moment to the present time the descendants of the Huguenots have had peace.

There are now about half a million Calvinists in

France; in the Gard, the ancient Desert, nearly a quarter of the whole body still abide. Of late years the Protestant Church in France has shown a tendency to division into two parties, that of the more rigid Calvinistic opinions, and that of a more liberal and less orthodox theology. In either case they form a group of loyal citizens, on whom French politicians now look with favor. The old reproach that "the Huguenots are all republicans" has at last turned to their credit.

The persecutions which checked all wholesome developments at home, whether religious, literary or commercial, were favorable to their growth abroad; and we consequently find that in literary and artistic excellence the Huguenots have taken their full share. Their first attention was naturally called to theology, in which the names of Calvin and Farel, Beza, Daillé, the Drélin-courts, the learned S. Desmarets, Jortin, P. Jurieu, Labadie the mystic, the Leclercs, the great Hebraist Mercier, Mestrezat the preacher, the old hero Duplessis Mornay, Salmasius, J. Saurin, first of Protestant orators, and a crowd of lesser men testify to their activity in this branch. Add to these the dictionary of Bayle, the works of the Basnages, Morin the Orientalist, Pithou, the Daciers, Étienne Dolet, Ranius, Le Févre of Étaples, above all Scaliger, as leaders in learning; in history Bénédict, Bongars, Palma Cayet, Hubert Languet, Béroalde, and Rapin-Thoyras; and with them the political writer Hotman. Of lawyers they claim Baudouin, Cujas, Coras, Doneau, Héroult, and Godefroy, famed as the most learned of jurisconsults. In science they have the Cuviers, Desmaizeaux, Dubois the chemist, Paré, father of modern surgery, Papin, herald of the steam engine, the physician Joubert, L'Ecluse the botanist, and the Hubers. In art they lay claim to Crispin, J. Cousin, Pallissy, Simon the engraver, the Picarts, and Goujon the architect. Their poets are Marot and Margaret of Valois. The general effect of this activity is hard to gauge: from Amsterdam and Berlin, Geneva and London, issued sermon, political pamphlet, controversial polemic; but these efforts had no settled audience, they failed to win the ear of France. The same is true of their religious heroism; though it seemed to be exactly what was wanted to strengthen the national character, the confessors were scattered, like the Jews, among the nations, and ceased to affect the progress of their fatherland. In the Revolution we can see traces of their mental and moral activity; it may be that their day of influence is not yet over. For their history is a standing marvel, illustrating the abiding power of strong religious convictions, narrow in theory, pure in practice; they have stood as much ill-usage as has befallen any branch of Christ's church. It remains for their descendants to show to France that their creed goes well with freedom and advance—that the religious instinct, so deeply implanted in man, is a true friend of orderly and rational national life. Religion which does not abuse its power, a freedom from divided allegiances, an aptitude for constitutional institutions, and an intelligent belief in the sovereignty of the people—these are the elements which the Huguenots of to-day can bring to the service of the republic under which they dwell safely, none making them afraid.

HULL, or KINGSTON-UPON-HULL, a municipal and parliamentary borough, and one of the principal seaport towns of England, is, though a county in itself, locally within the East Riding of Yorkshire, on the west side of the Hull, where it discharges into the estuary of the the Humber, twenty miles from the German Ocean at Spurn Head. By rail it is forty-one and one-half miles east-southeast of York.

The staple industry of Hull is seed-crushing for oil and cake making. It possesses extensive engineering

works and foundries, large iron shipbuilding yards, rope-yards, sail-lofts, tanneries, breweries, flax and cotton mills, chemical works, and manufactures of blue and black lead, paints, colors, and varnishes, Portland and Roman cement, phosphate of lime, tobacco, starch, paper, soap, furniture, and organs. Population (1889), 208,000.

HULL, the chief town of Ottawa county, Quebec, is situated on the Ottawa river, opposite Ottawa City. The chief industries are woolen mills, planing mills, match, pail and wooden-ware factories, all of which are run by water power, which is here in great abundance. The Chaudiere Falls, a magnificent cataract, is spanned at this point by a handsome suspension bridge. Iron mines in the vicinity are worked. Population, 6,890. The city has good railroad communications.

HULS, a town of Prussia, in the circle of Kempen, and government district of Düsseldorf, is situated at the terminus of a branch railway line to Crefeld and Düsseldorf, four miles north of Crefeld and seventeen northwest of Düsseldorf.

HULSE, JOHN, founder of the Hulsean lectureship at the university of Cambridge, was born at Middlewich, in Cheshire, in 1708. Entering St. John's College, Cambridge, he graduated in 1728, and on taking holy orders was presented to a small country curacy. His father having died in 1753, Hulse succeeded to his estates in Cheshire, where, owing to feeble health, he lived in retirement till his death in 1789.

HUMBLE-BEE, a name applied by phonetic instinct, under various inflections, to the large bees of the genus *Bombus* (which, like the French "Bourdon," is probably also suggested by the noise made by these insects). They belong to the social section of the great family *Apidae*, of which the common hive-bee is the type, and, like that well-known insect, live in colonies composed of the two sexes and neuters. Instead of a single female (or queen), however, many are found in one nest; and the workers do not hibernate. The female also differs from the queen hive-bee in having dense fringes of hairs on the pollen-plates of the hind legs, and a widened base to the hind tarsi, a structure necessitated by her having to work single-handed at the commencement of the season, as the workers and males do not survive the winter. There are two kinds of females, the smaller one only producing male eggs, but not surviving the winter. The number of individuals in a colony varies with the different species, and as a rule is least in those building their nest above ground. There is considerable difference between the males, females and neuters; the last two differ, however, but little except in size, whereas the males often exhibit a very varying coloration, and have structural peculiarities, such as an additional segment to the abdomen, longer antennæ and tongue, no pollen-basket, etc. They have also no sting, whereas both female and worker are armed like the hive-bee. Great difficulty exists in referring these three constituents to their proper species, owing to individual variation, alteration with age, and the difficulty of seeing all the members of a colony at the same time; so that naturalists are not by any means agreed as to the specific status of many of them, and the synonymy is very complicated. The nests are not constructed after the symmetrical fashion of those of the hive-bee, but consist of a collection of oval brownish cells, at first few in number, but receiving additions and extensions as the brood increases, and accompanied by cells containing pollen and honey. The workers assist in rearing the larvæ, and in disengaging the individuals from the pupal integuments as they reach the perfect state; and it has been noticed that this metamorphosis is accelerated by a kind of incubation.

The nests are made under bushes, in banks, etc., sometimes as much as five feet from the surface. A well-known one is made by the "Moss-carder" humble-bee, *Bombus muscorum*, which has often been observed collecting the natural material for its dome, working in line. As usual with provident or social animals, these interesting insects are subject to encroachment by parasites of various kinds; most noteworthy among which are some species (there are three or four in England) of the closely allied genus *Apathus* (or *Psithyrus*), superficially resembling exactly the true humble-bees, but with no pollen-collecting apparatus, and no workers.

HUMBOLDT, a river of Nevada, rises in the north-east part of the State, and flows west-southwest to Humboldt Sink, a lake over forty miles in circumference, which has no outlet. Length, nearly 350 miles. The river, which is unnavigable even for canoes, is strongly impregnated with alkaline matter. The region through which it flows is barren.

HUMBOLDT, FRIEDRICH HEINRICH ALEXANDER, BARON VON, a distinguished naturalist and traveler, was born at Berlin, September 14, 1769. The childhood of Alexander von Humboldt was not a promising one, as regards either health or intellect. His characteristic tastes, however, soon displayed themselves. Destined for a political career, he studied finance during six months at the university of Frankfort-on-the-Oder; and a year later, April 25, 1789, he matriculated at Göttingen. His vast and varied powers were by this time fully developed; and during the vacation of 1789 he gave a fair earnest of his future performances in a scientific excursion up the Rhine, and in the treatise thence issuing, *Mineralogische Beobachtungen über einige Basalte am Rhein* (Brunswick, 1790). His researches into the vegetation of the mines of Freiberg led to the publication, in 1793, of his *Floræ Fribergensis Specimen*; and the results of a prolonged course of experiments on the phenomena of muscular irritability, then recently discovered by Galvani, were contained in his *Versuche über die gereizte Muskel- und Nervenfasern* (Berlin, 1797), enriched in the French translation with notes by Blumenbach.

In 1794 he was admitted to the intimacy of the famous Weimar coterie, and contributed (June, 1795) to Schiller's new periodical *Die Horen*, a philosophical allegory entitled *Die Lebenskraft, oder der rhodische Genius*. In the summer of 1790 he paid a flying visit to England in company with Forster. In 1792 and 1797 he was in Vienna, in 1795 he made a geological and botanical tour through Switzerland and Italy. The death of his mother, November 19, 1796, set him free to follow the bent of his genius, and, finally severing his official connections, he waited for an opportunity of executing his long-cherished schemes of travel. On the postponement of Captain Baudin's proposed voyage of circumnavigation, which he had been officially invited to accompany, he left Paris for Marseilles with Bonpland, the designated botanist of the frustrated expedition, hoping to join Bonaparte in Egypt. The means of transport, however, were not forthcoming, and the two travelers eventually found their way to Madrid, where the unexpected patronage of the minister d'Urquijo determined them to make Spanish America the scene of their explorations.

Armed with powerful recommendations, they sailed in the *Pizarro* from Corunna, June 5, 1799, stopped six days at Teneriffe, for the ascent of the Peak, and landed, July 16th, at Cumana. There Humboldt observed, on the night of the 12-13th of November, that remarkable meteor-shower which forms the starting-point of our acquaintance with the periodicity of the phenomenon; thence he proceeded with Bonpland to

Caracas; and in February, 1800, he left the coast for the purpose of exploring the course of the Orinoco. This trip, which lasted four months, and covered 1,725 miles of wild and uninhabited country, had the important result of establishing the existence of a communication between the water-systems of the Orinoco and Amazon, and of determining the exact position of the bifurcation. On November 24th the two friends set sail for Cuba, and after a stay of some months regained the mainland at Cartagena. Ascending the swollen stream of the Magdalena, and crossing the frozen ridges of the Cordilleras, they reached Quito after a tedious and difficult journey, January 6, 1802. Their stay there was signalized by the ascent of Pichincha and Chimborazo, and terminated in an expedition to the sources of the Amazon *en route* for Lima. At Callao Humboldt observed the transit of Mercury on November 9th, and studied the fertilizing properties of guano, the introduction of which into Europe was mainly due to his writings. A tempestuous sea-voyage brought them to the shores of Mexico, and after a year's residence in that province, followed by a short visit to the United States, they set sail for Europe from the mouth of the Delaware, and landed at Bordeaux, August 3, 1804.

His discovery of the decrease in intensity of the earth's magnetic force from the poles to the equator was communicated to the Paris Institute in a memoir read by him, December 7, 1804, and its importance was attested by the speedy emergence of rival claims. His services to geology were mainly based on his attentive study of the volcanoes of the New World.

The reduction into form and publication of the encyclopædic mass of materials—scientific, political, and archæological—collected by him during his absence from Europe, was now Humboldt's most urgent desire. After a short trip to Italy with Gay-Lussac, for the purpose of investigating the law of magnetic declination, and a sojourn of two years and a half in his native city, he finally, in the spring of 1808, settled in Paris with the view of securing the scientific coöperation required for bringing his great work through the press. With the exception of Napoleon Bonaparte, he was now the most famous man in Europe. He refused the appointment of Prussian minister of public instruction in 1810. In 1814 he accompanied the allied sovereigns to London. Three years later he was summoned by the king of Prussia to attend him at the congress of Aix-la-Chapelle. Again in the autumn of 1822 he accompanied the same monarch to the congress of Verona, proceeded thence with the royal party to Rome and Naples, and returned to Paris in the spring of 1823.

The French capital he had long regarded as his true home. Thus, when at last he received from his sovereign a summons to join his court at Berlin, he obeyed indeed, but with deep and lasting regret. On May 12, 1827, he settled permanently in the Prussian capital, where his first efforts were directed toward the furtherance of the science of terrestrial magnetism. His appeal to the Russian government in 1829 led to the establishment of a line of magnetic and meteorological stations across northern Asia; while his letter to the duke of Sussex, then (April, 1836) president of the Royal Society, secured for the undertaking the wide basis of the British dominions. Thus that scientific conspiracy of nations which is one of the noblest fruits of modern civilization was by his exertions first successfully organized.

In 1811, and again in 1818, projects of Asiatic exploration were proposed to Humboldt, first by the Russian, and afterward by the Prussian government; but on each occasion untoward circumstances interposed, and it was not until he had entered upon his sixtieth

year that he resumed his early rôle of a traveler in the interests of science. Between May and November, 1829, he, together with his chosen associates Gustav Rose and Ehrenberg, traversed the wide expanse of the Russian empire from the Neva to the Yenesei, accomplishing in twenty-five weeks a distance of 9,614 miles. The journey, however, though carried out with all the advantages afforded by the immediate patronage of the Russian government, was too rapid to be profitable. Its most important fruits were the correction of the prevalent exaggerated estimate of the height of the Central-Asian plateau, and the discovery of diamonds in the gold-washings of the Ural—a result which Humboldt's Brazilian experiences enabled him to predict, and by predicting to secure.

Between 1830 and 1848 Humboldt was frequently employed in diplomatic missions to the court of Louis Philippe, with whom he always maintained the most cordial personal relations. The death of his brother, Wilhelm von Humboldt, who expired in his arms, April 8, 1835, saddened the later years of his life. In losing him, Alexander lamented that he had "lost half himself." The accession of the crown prince as Frederick William IV., on the death of his father, in June, 1840, added to rather than detracted from his court favor. Indeed, the new king's craving for his society became at times so importunate as to leave him only some hours snatched from sleep for the prosecution of his literary labors.

It is not often that a man postpones to his seventy-sixth year, and then successfully executes, the crowning task of his life. Yet this was Humboldt's case. The first two volumes of the *Kosmos* were published, and in the main composed, between the years 1845 and 1847.

The last decade of his long life—his "improbable" years, as he was accustomed to call them—was devoted to the continuation of this work, of which the third and fourth volumes were published in 1850-58, and a fragment of a fifth appeared posthumously in 1862.

On February 24, 1857, Humboldt was attacked with a slight apoplectic stroke, which, however, passed away without leaving any perceptible trace. It was not until the winter of 1858-59 that his strength began to decline, and on the ensuing 6th of May he tranquilly expired, wanting but six months of completing his ninetieth year. The honors which had been showered on him during life followed him after death. His remains, previously to being interred in the family resting-place at Tegel, were conveyed in state through the streets of Berlin, and received by the prince-regent with uncovered head at the door of the cathedral. The first centenary of his birth was celebrated September 14, 1869, with equal enthusiasm in the New as in the Old World; and the numerous monuments erected in his honor, and newly-explored regions called by his name, bear witness to the universal diffusion of his fame and popularity.

HUMBOLDT, KARL WILHELM VON, the elder brother of the more celebrated Alexander von Humboldt, was born at Potsdam, on June 22, 1767. After being educated at Berlin, Göttingen, and Jena, in the last of which places he formed a close and lifelong friendship with Schiller, he married Fräulein von Dacherode, a lady of birth and fortune, and in 1802 was appointed by the Prussian Government first resident and then minister plenipotentiary at Rome. While there he published a poem entitled *Rom*, which was reprinted in 1824. This was not, however, the first of his literary productions; his critical essay on Goethe's *Hermann and Dorothea*, published in 1800, had already placed him in the first rank of authorities in æsthetics, and, together with his family connections, had ~~led~~ ^{led} to do

with his appointment at Rome; while in the years 1795 and 1797 he had brought out translations of several of the odes of Pindar, which were held in high esteem.

In order to gain a practical knowledge of the language and complete his investigations of it, he visited the Basque country itself, the result of his visit being the valuable "*Researches into the Early Inhabitants of Spain by the help of the Basque Language*," published in 1821. In this work he endeavored to show, by an examination of geographical names, that a race or races speaking dialects allied to modern Basque, once extended through the whole of Spain, the southern coast of France, and the Balearic Islands, and suggested that these people, whom he identified with the Iberians of classical writers, had come from northern Africa, where the name of Berber still perhaps perpetuates their old designation. Another work on what has sometimes been termed the metaphysics of language appeared from his pen in 1828, under the title of *Ueber den Dualis*; but the great work of his life, on the ancient Kawi language of Java, was, unfortunately, interrupted by his death, on April 8, 1835.

HUME, DAVID, the most subtle metaphysician and one of the greatest historians and political economists of Great Britain, was born at Edinburgh, on April 26 (O.S.), 1711. David was the youngest of a family of three, two sons and a daughter, who after the early death of the father were brought up with great care and devotion by their mother.

Of Hume's early education little is known beyond what he has himself stated in his *Life*. He appears to have entered the Greek classes of the university of Edinburgh in 1723, and, he tells us, "passed through the ordinary course of education with success." At an unusually early age he had determined for himself his future course, and no inducement was strong enough to make him swerve from it. His temperament, on the whole placid and even phlegmatic, readily inclined him to seek as his mode of life the golden mean, equally removed from such external influences as could distract or disturb contemplative repose. He practiced what he taught and learned of the Stoic rules, and was concerned only to obtain such external fortune as would place him above the necessity of wasting his powers on temporary and transient objects. His prudence was as remarkable as his moderation; and his life, on the whole, may be regarded as one of the most perfect and successful instances of constant devotion to literary aims.

We see Hume, then, in the years during which the influences that mold a man's character and career are most actively at work, resolutely devoting himself to a life of literature, possessed by the most intense ambition for literary fame, and busying himself with reflection upon those problems of "philosophy and critics" in which, as he found, "nothing was yet established." His means were slender, and it was necessary for him, even in view of his primary object, to endeavor after independence. The first choice of a profession, that of law, made for him by his relatives, who thought it suited to his "studious habits, sobriety, and industry," proved unsuccessful. The intensity of his studies, the agitation due to the novelty of the ideas which began to crowd upon him as he tried to carry out systematically the first principles of human knowledge which he learned from Locke and Berkeley, combined to throw him for a time into a state of physical exhaustion and lassitude. His health was gradually restored by more careful regimen; but, as we learn from the curious diagnosis he made of his own state, the vigor requisite for protracted and connected speculation seemed to have vanished. The effectual remedy which commended itself to him was the

trial of a mercantile life, and early in 1734 he set out for Bristol, armed with recommendations to some eminent merchants. A residence of a few months was sufficient to convince him that in this attempt at least he had not hit the mark. He visited Paris, resided for a time at Rheims, and then settled at La Flèche, famous in the history of philosophy as the school of Descartes. His health seems to have been perfectly restored, and during the three years of his stay in France his speculations were worked into systematic form in the *Treatise of Human Nature*. In the autumn of 1737 he was in London negotiating with publishers and printers regarding the appearance of his great work, and carefully pruning and polishing it in preparation for the judgments of the learned. In January, 1739, there appeared the first and second volumes of the *Treatise of Human Nature, being an Attempt to Introduce the Experimental Method of Reasoning into Moral Subjects*, containing book i., *Of the Understanding*, and book ii., *Of the Passions*. The third volume, containing book iii., *Of Morals*, was published in the following year.

After the publication of the *Treatise* Hume retired to his brother's house at Ninewells and carried on his studies, mainly in the direction of politics and political economy, adding to this, however, a wide if not exact reading in classical literature. In 1741 he published the first volume of his *Essays*, which had a considerable and immediate success. A second edition was called for in the following year, in which also a second volume was published.

The success of the *Essays*, though hardly great enough to satisfy the author's somewhat exorbitant cravings, was a great encouragement to Hume. He began to hope that his earlier and heavier work, if recast and lightened, might share the fortunes of its successor; and at intervals throughout the next four years he occupied himself in reducing its fundamental principles into a more succinct form, and in giving to them all the literary grace at his command. Meantime he continued to look about for some post which might secure him the modest independence he desired.

In 1746 Hume accepted the office of secretary to General St. Clair, and was a spectator of the ill-fated expedition to France in the autumn of that year. His admirable account of the transaction has been printed by Mr. Burton. After a brief sojourn at Ninewells, doubtless occupied in preparing for publication his *Philosophical Essays* (afterward entitled *An Inquiry Concerning Human Understanding*), Hume was again associated with General St. Clair, and in 1748 accompanied him as secretary in the embassy to Vienna and Turin. The notes of this journey are written in a light and amusing style, showing Hume's usual keenness of sight in some directions and his almost equal blindness in others. During his absence from England, early in the year 1748, the *Philosophical Essays* were published; but, to his great disappointment, the first reception of the work was little more favorable than that accorded to the unfortunate *Treatise*.

In 1749 Hume returned to England, enriched with "near a thousand pounds." Two years he spent at Ninewells, and then in 1751 removed to Edinburgh, where for the most part he resided during the next twelve years of his life. These years are the richest so far as literary production is concerned. In 1751 he published his *Political Discourses*, which had a great and well-deserved success. In the same year appeared the recast of the third book of the *Treatise*, called *Inquiry Concerning the Principles of Morals*, of which he says that "of all his writings, philosophical, literary, or historical, it is incomparably the best." At this time also we hear of the *Dialogues Concerning Natural Religion*, a work

which Hume was prevailed on not to publish, but which he touched and retouched with the greatest care, and evidently regarded with the greatest favor. The work itself, left by Hume with instructions that it should be published, did not appear till 1779.

In 1751 Hume was again unsuccessful in the attempt to gain a professor's chair. A candidate unknown to fame then or afterward was appointed to the chair of logic at Glasgow. In the following year he received the first public preferment that had ever fallen to his lot, the librarianship of the Advocates' Library in Edinburgh, small in emoluments, but rich in opportunity for literary work.

The only work published at this time which requires somewhat special notice is the set of essays called *Political Discourses*.

In 1753 Hume was fairly settled in Edinburgh, enjoying the dignity and delights of householding, and prepared for his new attempt in literature, the *History of England*. He had decided to begin the *History*, not with Henry VII., as Adam Smith recommended, but with James I. Within a very few years the sale of the *History* was sufficient to gain for the author a larger revenue than had ever before been known in his country to flow from literature, and to place him in comparative affluence. It is from the publication of the *History* that we date the extraordinary virulence of his hatred toward everything English, toward society in London, Whig principles, Whig ministers, and the public generally. The second volume, published in 1756, carrying on the narrative to the Revolution, was better received than the first. The early portion of his *History* may be regarded as now of little or no value. The sources at Hume's command were few, and he did not even use them all. None the less, the *History* has a distinct place in the literature of England. It was the first attempt at a really comprehensive and thoughtful treatment of historic facts, the first to introduce the social and literary aspects of a nation's life as of importance only second to its political fortunes, and the first historical writing in an animated yet refined and polished style. It has received from later writers its due meed of praise and blame.

While the *History* was in process of publication, Hume did not entirely neglect his other lines of activity. In 1757 appeared *Four Dissertations: The Natural History of Religion, Of the Passions, Of Tragedy, Of the Standard of Taste*. Of these the dissertation on the passions is a very subtle piece of psychology, containing the essence of the second book of the *Treatise*. It is remarkable that Hume does not appear to have been acquainted with Spinoza's analysis of the affections. The last two essays are contributions of no great importance to æsthetics, a department of philosophy in which Hume was not strong. The *Natural History of Religion* is a powerful contribution to the deistic controversy; but, as in the case of Hume's earlier works, its significance was at the time overlooked. It is an attempt to carry the war directly into a province hitherto allowed to remain at peace, the theory of the general development of religious ideas. Deists, though raising doubts regarding the historic narratives of the Christian faith, had never disputed the general fact that belief in one God was natural and primitive. Hume endeavors to show that polytheism was the earliest as well as the most natural form of religious belief, and that theism or deism is the product of reflection upon experience, thus reducing the validity of the historical argument to that of the theoretical proofs.

In 1763 he accompanied Lord Hertford to Paris, doing the duties of secretary to the embassy, with the prospect of the appointment to that post. He was

everywhere received "with the most extraordinary honors;" in fact, he was "lionized." The society of Paris was peculiarly ready to receive a great philosopher and historian, especially if he were known to be an avowed antagonist of religion. Hume basked in the sunshine of his popularity; but at the same time he made some valuable friendships, especially with D'Alembert and Turgot, the latter of whom admired sincerely and profited much by Hume's economical essays. In 1766 he left Paris and returned to Edinburgh; but in the following year (1767) he accepted the post of under-secretary to General Conway, and spent two years in London. He settled finally in Edinburgh in 1769, having now through his pension and otherwise the handsome fortune of £1,000 a year. The solitary incident of note in this period of his life is the ridiculous quarrel with Rousseau, an episode still amusing, and throwing much light upon the strange character of the great sentimentalist. Hume certainly did his utmost to secure for Rousseau a comfortable retreat in England, but his usually sound judgment seems at first to have been quite at fault with regard to his protégé. That is surely an amusing likeness which Hume discovered between Rousseau and Socrates; and it is interesting to note the conflict between his preconceived opinion and that which detached circumstances gave him occasion to form. He finds "Rousseau a very modest, mild, well-bred, gentle-spirited and warm-hearted man as I ever knew in my life," and thinks he "could live with him all his life in mutual friendship and esteem." At the same time he cannot avoid remarking that Rousseau "is a great humorist" (*i.e.*, full of caprices); that though "he intends seriously to draw his own picture in its true colors * * * nobody knows himself less;" that he would be unhappy in solitude, "as he has, indeed, been always in all situations." The quarrel which all the acquaintances of the two philosophers had predicted soon came, and no language had expressions strong enough for Rousseau's hatred and distrust of his protector. Hume, it must be admitted, came well out of the business, and had the sagacity to conclude that, after all, his admired friend was little better than a madman.

In 1769 Hume settled in Edinburgh, and in one of his most delightful letters he gives an animated description of the domestic economy of his later years. The house alluded to as that to which he was about to remove was built under his own directions at the corner of what is now called St. David street; and we may picture it to ourselves as being, during the closing period of Hume's life, the center of the most lively and cultivated society of Edinburgh. The gay and cheerful temper of the philosopher, his unfailing equanimity, and the solid goodness of his heart had made him many friends, even among those who dissented most from his religious views. The resolute strength with which he pushed speculation to its limits was combined with a perfect gentleness of disposition and an amiability that endeared him to all who had the pleasure of knowing him. He was singularly free from jealousy, and no feature of his character is more attractive than the unfailing cordiality with which he welcomed the literary successes of those who might have been thought his rivals. To Robertson and Smith, his personal friends, he is open and unrestrained in his praise and commendation; and his good services were ever exerted in their cause. To opponents, of whose merits he was convinced, to Campbell and Reid, he was cordial and generous. His respect for his own profession led him always to encourage those who had engaged their fortunes in the perilous hazard of literary success, and to extend to them his good offices. For Blackwell and for Smollett, in their misfortunes, he exerted himself to the utmost. Nor was he without his

recompense. During the closing decade of his life he was the acknowledged patriarch of literature; the veneration and respect of his friends, for his character no less than for his abilities, were unbounded. The "gayety of his temper," says Adam Smith, "so agreeable in society, and which is so often accompanied with frivolous and superficial qualities, was in him certainly attended with the most severe application, the most extensive learning, the greatest depth of thought, and a capacity in every respect the most comprehensive. Upon the whole, I have always considered him, both in his lifetime and since his death, as approaching as nearly to the idea of a perfectly wise and virtuous man as perhaps the nature of human frailty will permit."

In the spring of 1775 Hume was struck with a tedious and harassing though not painful illness. A visit to Bath seemed at first to have produced good effects, but on the return journey northward more alarming symptoms developed themselves, his strength rapidly sank, and, little more than a month after he reached Edinburgh, he died (August 25, 1776).

HUME, JOSEPH, an eminent political reformer, was born in January, 1777, at Montrose, Scotland. He died February 20, 1855.

HUMERUS, LARS JOHANSSON, Swedish poet, more commonly known as Lucidor the Unfortunate, was born in Stockholm about the year 1642. He was murdered on the night of August 13, 1674, in a cellar at Stockholm, by a drunken soldier, Lieutenant Arvid Storm, with whom he was quarreling.

HUMILIATI, a religious order founded at Milan early in the twelfth century, by certain noblemen of Lombardy, who, having been carried captive into Germany, had regained their freedom by their "humility," did not, according to Helyot in his *Orders Monastiques*, take the monastic vows till 1134, when they were induced to do so by St. Bernard. In 1164 their ranks were recruited by other Milanese noblemen who had been similarly carried into Germany by Frederick Barbarossa. About 1151 the order was brought under the rule of St. Benedict, and in 1200 it was approved by Innocent III. Confirmed and privileged by succeeding popes, the Humiliati began to be corrupted by their popularity and prosperity, until, after a futile attempt to reform the order, Pius V. finally suppressed it in 1571.

HUMMEL, JOHANN NEPOMUK, a celebrated composer and pianist, was born November 14, 1778, at Pressburg, in Hungary. He died in 1837 at Weimar, where for a long time he had been the musical conductor of the court theater.

HUMMING-BIRD, a name in use for more than two centuries, and possibly ever since English explorers first knew of the beautiful little animals to which, from the sound occasionally made by the rapid vibrations of their wings, it is applied. Barrere, in 1745, conceiving that Humming-birds were allied to the wren, the *Trochilus*, in part, of Pliny, applied that name in a generic sense. Taking the hint thus afforded, Linnæus very soon after went further, and, excluding the wrens, founded his genus *Trochilus* for the reception of such Humming-birds as were known to him. The unfortunate act of the great nomenclator cannot be set aside; and, since his time, ornithologists with but few exceptions have followed his example, so that nowadays Humming-birds are universally recognized as forming the family *Trochilidæ*.

The relations of the *Trochilidæ* to other birds were for a long while very imperfectly understood. Nitzsch first drew attention to their agreement in many essential characters with the swifts, *Cypselidæ*, and placed the two families in one group, which he called *Macrochires*, from the great length of their manual bones, or those

forming the extremity of the wing. The name was perhaps not very happily chosen, for it is not the distal portion that is so much out of ordinary proportion to the size of the bird, but the proximal and median portions, that in both families are curiously dwarfed. Still the *manus*, in comparison with the other parts of the wing, is so long that the term *Macrochires* is not wholly inaccurate. The affinity of the *Trochilidæ* and *Cypselidæ*, once pointed out, became obvious to every careful and unprejudiced investigator, and there are probably few systematists now living who refuse to admit its validity. More than this, it is confirmed by an examination of other osteological characters. The "lines," as a boatbuilder would say, upon which the skeleton of each form is constructed are precisely similar, only that whereas the bill is very short and the head wide in the swifts, in the Humming-birds the head is narrow and the bill long—the latter developed to an extraordinary degree in some of the *Trochilidæ*, rendering them the longest-billed birds known. Professor Huxley considers these two families, together with the Goatsuckers, to form the division *Cypselomorpha*—one of the two into which he has separated his larger group *Ægithognathæ*. However, the most noticeable portion of the Humming-bird's skeleton is the *sternum*, which in proportion to the size of the bird is enormously developed both longitudinally and vertically, its deep keel and posterior protraction affording abundant space for the powerful muscles which drive the wings in their rapid vibrations as the little creature poises itself over the flowers where it finds its food.

Humming-birds, as is well known, comprehend the smallest members of the class *Aves*. The largest among them measures no more than eight inches and a half, and the least two inches and three-eighths in length, for it is now admitted generally that Sloane must have been in error when he described the "Least Humming-bird of Jamaica" as "about one and one-quarter inches long from the end of the bill to that of the tail"—unless, indeed, he meant the proximal end of each, an interpretation, however, that will not save Edwards and Latham from the charge of careless misstatement, when they declare that they have received such a bird from that island.

HUNDRED, in England, is an ancient territorial division intermediate between the parish or township and the county. Such subordinate districts were also known in different parts of the country as *wapentakes*, *wards*, and sometimes *shires*. The name *wapentake*, which seems to have a distinct reference to the military side of the organization, is generally connected with the Danish occupation and is said to be found only in the Anglian districts.

HUNGARY, the second factor of the dual Austrian-Hungarian monarchy, is an extensive country in the southeastern portion of Central Europe. It thus covers about 5° of latitude and 12° of longitude, and contains an area of 124,234 square miles, or more than half of the whole Austrian-Hungarian realm.

The kingdom of Hungary in its widest extent, or the "Realm of the Crown of St. Stephen," comprises Hungary Proper, with the former grand-principality of Transylvania, the town and district of Fiume, Croatia and Slavonia, and the Military Frontier. Dalmatia, which both from its geographical position and from historical associations ought also to form part of Hungary, sends its representatives to the Austrian Reichsrath.

	Area in Eng. Miles.
Hungary Proper and Transylvania.....	108,263
Fiume	8
Croatia and Slavonia.....	8,665
Military Frontier.....	7,298
Total.....	124,234

In the article AUSTRIA the Austrian-Hungarian monarchy has already been treated of as a whole, and under the heading CROATIA AND SLAVONIA will be found further special information with reference to that province (see also FIUME). In the present article we shall therefore treat generally of the lands belonging to the Hungarian crown, and more particularly of the "mother country," or Hungary Proper and Transylvania.

The province of Hungary Proper and Transylvania, now united under one administration, and sometimes officially styled simply "Hungary," comprises an area of 108,263 English square miles. It is bounded on the north by Moravia, Silesia, and Galicia; on the east by Bukowina and Moldavia; on the south by Wallachia, Servia, and Croatia and Slavonia; and on the west by Styria, Lower Austria, and Moravia. The narrow strip of country known as the Military Frontier, which stretches as a border line between Bosnia and Servia and the south of Croatia and Slavonia, prior to 1873 extended beyond the limits of that province, through Hungary Proper to Transylvania. The whole Military Frontier thus constituted formerly a joint crown land, consisting of the present Croatian-Slavonian frontier, and the so-called Servian-Bánát frontier, now incorporated into the province of Hungary Proper and Transylvania. The political changes introduced between 1868 and 1876 will be considered below.

With the exception of the short extent of seaboard on the Adriatic belonging to the Hungarian Littorale, the Hungarian monarchy is entirely surrounded by other countries. Its natural boundaries are for the most part well defined: on the northwest and north it is separated from Moravia, Silesia, and Galicia by the Carpathian mountains; on the east and southeast the Eastern Carpathians form a natural barrier between Transylvania and Moldavia and Wallachia; on the south it is bounded by the Danube, Save and Unna, which separate it from Servia and Bosnia; on the southwest by Dalmatia and the Adriatic; and on the west, where its natural boundaries are not so clearly marked, by Carniola, Styria, and Lower Austria. From the river Lajta or Leitha, which, like the March, forms a portion of the boundary of the last-mentioned province, originate the terms Cisleithan and Transleithan, sometimes applied to the collective provinces of Austria and of Hungary respectively.

The mountains of Hungary belong to the two great European systems, the Carpathians and the Alps. The former extend in a semicircular form over the north and east of the monarchy, inclosing the whole of the left basin of the Danube from Dévény near Pozsony (Pressburg) to Orsova, while spurs of the Styrian Alps traverse the country in the west; to these latter belong also the Bakony and Vértes ranges. The mountainous lands in the southwest of the Hungarian monarchy are in elevation much inferior to those in the north and east, but their greater proximity to the sea and their frequently bare and rugged character cause them to have a considerable influence both on the climate and commercial relations of the country.

The great Carpathian and Alpine mountain systems inclose two extensive plains, the smaller of which, called the "Little Hungarian Alföld" or "Pressburg Basin," covers an area of about 6,000 square miles, and lies to the west of the Bakony and Mátra ranges, which separate it from the "Pest Basin" or "Great Hungarian Alföld." This is the largest plain in Europe, and comprises an area of about 37,000 square miles, with an average elevation of from 300 to 350 feet above the level of the sea. The Pest Basin extends over the greater portion of central and southern Hungary, and

is traversed by the Theiss and its numerous tributaries. This immense tract of low land, though in some parts covered with barren wastes of sand, alternating with marshes, presents in general a very rich and productive soil.

The numerous caverns deserve a passing notice. One of them, the Aggtelek cave, in the county of Gömör, is about fifty feet in breadth by sixteen in height, and extends in its recesses for a length of several thousand feet. In it various fossil mammalian remains have been found. The Fonácza cave, in the county of Bihar, has also yielded fossils. No less remarkable are the Okno, Vodi and Deményfalva caverns in the county of Liptó, the Veterani in the Bánát, and the ice cave at Dobsina in Gömör county. Of the many interesting caverns in Transylvania the most remarkable are the sulphurous Büdös in the county of Háromszék, the Almás to the south of Udvarhely, and the brook-traversed rocky caverns of Csetate-Boli, Pestere and Ponor in the southern mountains of Hunyad county.

Nature has amply provided the greater part of Hungary with both rivers and springs, but some trachytic and limestone mountainous districts show a marked deficiency in this respect. The Mátra group, *e.g.*, is poorly supplied, while the outliers of the Vértes mountains toward the Danube are almost entirely wanting in streams, and have but few water-sources. A relative scarcity in running waters prevails in the whole region between the Danube and the Drave. The greatest proportionate deficiency, however, is observable in the arenaceous region between the Danube and Theiss, where for the most part only periodical floods occur. This, however, is far from being the case in the north and east of the kingdom, where the rivers and streams are numerous. The misfortune is that the rivers of Hungary nearly all flow either mediately or immediately to the Danube, and are therefore not available in any other direction as a means of external communication, and even within the country can only serve to a limited extent as waterways.

The Balaton or Platten-See, the largest lake, not only in Hungary, but in the whole of the Austrian-Hungarian dominions, lies between the counties of Veszprém, Somogy, and Zala, is about forty-seven miles in length by three to nine in breadth, and with the surrounding marshes occupies an area of about 400 square miles. It is supplied by the river Zala, thirty-one small streams, and nine springs, while its surplus waters are carried off by the Sió. Phenomena peculiar to the Balaton lake are, that it sometimes becomes violently agitated without any apparent cause, and that in seasons of severe cold the ice on its surface occasionally bursts with a loud report. It is navigable for steamers, and abounds in fish.

The canals of Hungary are still far from sufficient for the wants of the country, although lately many improvements have been introduced, and enormous cuttings made in certain places to relieve the rivers from periodical overflow.

On the Adriatic, at the northern extremity of the short line of seacoast known as the "Hungarian Littorale," lies the port of FIUME (*q. v.*), which is the only direct outlet by sea for the produce of Hungary.

The climate of Hungary, owing to the physical configuration of the country, varies considerably.

The whole of Hungary, but more especially Hungary Proper, can boast of the great variety and number of its natural productions. This is attributable partly to its geographical position, but chiefly to the varied nature of its surface and climate. The fertility of the soil, if we except the mountainous and sandy regions, is remarkable. The vegetable products include almost

every description of grain, especially wheat and maize, besides Turkish pepper, rapeseed, hemp and flax, beans, potatoes, and root crops. Fruits of various descriptions, and more particularly melons and stone fruits, are abundant. In the southern districts almonds, figs, rice, and olives are grown. Among the forest and other trees are the oak, which yields large quantities of galls, the beech, fir, pine, ash, and alder, also the chestnut, walnut and filbert. The vine is cultivated over the greater part of Hungary. A great quantity of tobacco is also grown, but it is wholly monopolized by the crown. In Hungary Proper and in Croatia and Slavonia there are many species of indigenous plants, which are unrepresented in Transylvania. Besides twelve species peculiar to the former grand-principality, fourteen occur only there and in Siberia.

The fauna of Hungary includes about 14,000 species. The horned cattle are among the finest in Europe, and large herds of swine are reared in the oak forests. The wild animals are bears, wolves, foxes, lynxes, wild-cats, badgers, otters, martens, stoats and weasels. Among the rodents there are hares, marmots, beavers, squirrels, rats, and mice—the last in enormous swarms. Of the larger game the chamois and deer are specially noticeable. Among the birds are the vulture, eagle, falcon, buzzard, kite, lark, nightingale, heron, stork, and bustard. Domestic and wild fowl are generally abundant. The rivers and lakes yield enormous quantities of fish, and leeches are also plentiful. The Theiss, once better supplied with fish than any other river in Europe, has for many years fallen off in its productiveness. The culture of the silkworm is chiefly carried on in the south—in the Military Frontier, and in Croatia and Slavonia. The principal bee-bearing localities are in the counties of Cömör, Szepes, and Mosony, the Military Frontier, and the former Saxon districts of Transylvania.

The chief mineral products are coal, niter, sulphur, alum, soda, saltpeter, gypsum, porcelain-earth, pipe-clay, asphalt, petroleum, marble, and ores of gold, silver, mercury, copper, iron, lead, zinc, antimony, cobalt, and arsenic. The opals of Sáros are famous, and precious stones of various descriptions (chalcedony, garnet, jacinth, amethyst, carnelian, agate, rock-crystals, etc.) are met with in several localities. Amber occurs at Magura in Szepes county. The sand of some of the rivers, as for instance the Maros, Szamos, Körös, and Aranyos, is auriferous. Iron and coal are extensively produced. There are fine marble quarries. The largest salt-mines are at Rónaszék, Sugatag, and Szalatina in the county Máramaros, in Hungary Proper, and at Vizakna, Parajd, Torda, Deésakna, and Marosujvár in Transylvania. There are several hundred cold and sixty-four warm mineral springs in Hungary Proper and in Croatia and Slavonia, while a relatively greater number are met with in Transylvania.

Since the year 1867 the administrative and political divisions of the lands belonging to the Hungarian crown have been in great measure remodeled. In 1868 Transylvania was definitely reunited to Hungary Proper, and the town and district of Fiume declared autonomous. In 1873 the Servian-Bánát or Eastern Military Frontier was incorporated with Hungary Proper. In 1876 the whole administrative subdivision of Hungary into counties, districts, and sees was revised, and for the sake of uniformity one general system of counties was introduced, except for the Croatian-Slavonian Military Frontier, which is divided into border districts. The total number of subdivisions amounts to eighty, of which sixty-five appertain to Hungary Proper and Transylvania, one to Fiume and district, eight to Croatia and Slavonia, and six to the Croatian-Slavonian

Military Frontier. Hungary Proper, according to ancient usage, is generally divided into four great divisions or circles, and Transylvania has since 1876 been regarded as the fifth. Neither numerically nor according to territorial extent are the present sixty-five counties distributed equally among their respective circles, which must be regarded as geographical rather than political divisions, for they are not recognized in the judicial, fiscal, military, postal and administrative relations of the country.

The population of Hungary comprises a great variety of races, differing in language and religion, although united under one common sovereignty. At the census of 1880 the whole population, civil and military, amounted to 16,979,813.

Since the year 1867 great improvements have been effected in the educational system of Hungary, especially in Hungary Proper and Transylvania. Before that year public instruction was in the hands of the ecclesiastics of the various confessions, and the public schools had in consequence more or less of a denominational character. One of the first cares of the new responsible ministry of 1867 was to provide for the education of all children not attending the then existing scholastic establishments, by the introduction of supplementary non-denominational schools. By a law passed in 1868, the government made it compulsory on children of both sexes between the ages of six and twelve to attend school, and it moreover required that children from twelve to fifteen should attend the "repetition schools." The educational system of Croatia and Slavonia is autonomous, being under the independent direction of the Croatian-Slavonian provincial government.

The various educational establishments may be divided into four classes: common, middle, high, and special schools.

The form of government in Hungary is that of a constitutional monarchy. The sovereign power is at present vested in the house of Hapsburg-Lorraine, whose descendants succeed by right of primogeniture in the male line. By virtue of the Pragmatic Sanction, females may also reign in the event of there being no male successor. The king is the guardian of the laws, and the head of the army and of the executive. His power is limited by parliament, which consists of an upper and lower house, and must be summoned yearly and elected triennially. The upper house comprises four hundred and seven members, viz., three princes of the reigning house, thirty-one Roman and Greek Catholic prelates, eleven standard-bearers, fifty-seven lord-lieutenants of counties, three dukes, two hundred and nineteen counts, eighty-one barons, and two deputies for Croatia and Slavonia. The lower house, elected by the eligible taxpayers, consists of four hundred and forty-six members, of whom four hundred and three represent Hungary Proper and Transylvania (including also Fiume), and forty-three Croatia and Slavonia and the Military Frontier. The language used in the house is the Magyar, but the representatives of Croatia and Slavonia may use their native language. The executive is vested in a president of the cabinet and the following ministers: court; finance; interior; religion and education; justice; public works; agriculture, industry, and commerce; *honvéd* (home-defense); and a ministry for Croatia and Slavonia. For matters relating to its special provincial administration, Croatia and Slavonia has at Zágráb (Agram) its own government, at the head of which is the ban, who is nominated by the king. The departments are three—interior and finance, religion and education, and justice.

The judicial power is independent of the administrative, the functions of the minister of justice being to see

that the laws are properly applied. The supreme courts of justice, as also those of second instance for Hungary Proper and Transylvania and Fiume, are at Budapest. There is also a secondary court of appeal at Maros-Vásárhely in Transylvania.

The southwestern portion of Hungary, as formed by the Danube, belonged to the Roman Province of Pannonia; the southeastern portion, as formed by the Theiss (Ptol. iii. 8, § 4), to that of Dacia; the tract of country lying between these two rivers was inhabited by the Jazyges. As early as 274 A.D. Dacia was abandoned by the Romans to the Goths. In 376 the Huns crossed the Don, and, having overrun the intervening country, about 380 established themselves in Pannonia, where under Attila their power was so vastly extended that in 432 the authority of the Romans entirely ceased. After the death of Attila (453) the greater part of the country fell into the hands of the Ostrogoths and Gepidæ. These yielded in their turn to the Longobardi, who in 526–548 gained possession of the whole of Pannonia. When the latter removed to Italy in 568, the Avars entered, but they were reduced to subjection by Charlemagne in 791–796.

The history of Hungary really begins with the appearance of the Magyars in Europe about the year 884. It is generally admitted that they were a branch of the Turanian stock, and descendants of the ancient Scythians; certain affinities of language show them to be related to the Lapps, Esths, and Finns. They are believed to have wandered from the Ural mountains to the region of the middle Volga, and thence to have migrated westward over the Dnieper and the Bug. At the time of their crossing the Carpathians about 889, under the lead of Álmos, they were divided into seven tribes, united by a compact which guaranteed justice and equality among their members. At the death of Álmos, in 889, the chiefs of the tribes elected his son Arpád successor. His followers overran the whole of Hungary and Transylvania, extending their conquests beyond the ancient province of Pannonia. From the time of the conquest to the year 1000, Hungary was ruled by dukes, the regal title being first assumed by Vaik (Stephen).

Under Zoltán and Taksony the Hungarians made various expeditions beyond the limits of their own country, spreading terror and devastation through Europe. They were ultimately checked, however, by the emperor Henry I., near Merseburg, in 933, and afterward by Otho the Great at the Lech (955). These defeats caused the Hungarians to turn their attention to the consolidation of their power within their own territory. Geyza, who succeeded Taksony in 972, married a Christian princess, and also furthered the introduction of Christianity by intrusting the education of his son Vaik to Adalbert, bishop of Prague. On succeeding his father, Vaik applied for and received the title of "apostolic king" from the hands of Pope Sylvester II., and was crowned in the year 1000 under the name of Stephen. This monarch, known as "St. Stephen of Hungary," laid the foundation of many existing institutions. He subdivided the land into counties, and provided it with an ecclesiastical organization, establishing bishoprics, and founding churches, chapels, convents, and schools. Having elevated the bishops to the highest posts of trust and power in the state, he forced the people to pay tithes to the clergy. He also created a national council, consisting of the lords temporal and spiritual, and of the knights or lower nobility, from which assembly the subsequent diets originated. Stephen dying 1038, and leaving no heir, the queen, Gisela, contrived to gain the throne for her nephew Peter, but a portion of the nobles declared for

Aba, who was of Arpadian blood. In the wars which ensued both princes perished, when Andrew I., who was nearly related to Stephen I., succeeded to the throne in 1047, but he was ultimately forced to yield it to his brother, Béla I. The next monarch's reign that offers anything worthy of notice is that of Ladislaus I., whose religious zeal gained him the appellation of "Saint," and who was distinguished on account of his conquest of Croatia (1089) and part of Galicia (1093), and for his victories over the Cumans (1086-89), the invaders of Transylvania and the neighboring districts. His nephew Coloman, a brave and talented monarch, guarded the country against the depredations of the hosts of crusaders who passed through it during his reign. He also wrested Dalmatia from the Venetians (1102), and annexed it to the Hungarian kingdom. Coloman died in 1114, leaving the throne to his youthful son, Stephen II., who soon entangled himself in warfare with the neighboring princes. The reign of his successor, Béla II. (1131-41), like that of the other kings of the twelfth century, presents few features of interest. That of Andrew II. (1205-35) is celebrated on account of the "Golden Bull" or Hungarian Magna Charta, extorted from the king by the nobles in the year 1222, after his return from a crusade forced upon him by the pope. The Golden Bull guaranteed that the states should be convoked annually, that no noble was to be arrested without being first tried and legally condemned, that the property of the nobility should be exempt from dues, that foreign service was to be rewarded, that appointments to the highest offices should be under the control of the diet. It also contained numerous other clauses granting certain freedoms, privileges, and exemptions to the nobility and clergy, and included a proviso of the right of armed resistance to tyrannical measures on the part of the crown. This charter was duly sworn to by subsequent kings of Hungary, but the article relating to the right of appeal to arms was abrogated in 1687. A few years after the accession of Béla IV., son of Andrew II., the Tartars invaded and devastated the whole country, massacring great numbers of the population (1241-42). Béla did all in his power, by the introduction of German colonists, to retrieve the disasters inflicted by the invasion; but his wars with Austria and Styria, and the revolts of his son Stephen, were prejudicial to the restoration of order. He, however, successfully repelled a second Tartar invasion in 1261. The reigns of the next two monarchs, Stephen V. (1270-72) and Ladislaus IV. (1272-90), are noticeable chiefly for the wars on behalf of Rudolf of Austria against Ottokar of Bohemia. Ladislaus is said to have been murdered in 1290 amid violent commotions caused by his Cumanian amours. His successor, Andrew III., the last king of the Árpád dynasty, after a short but disturbed reign, died in 1301, leaving no issue.

On the death of Andrew III. the royal dignity became an object of competition. One party elected Wenceslaus, son of the king of Bohemia and Poland (1301-5), and after him Otho of Bavaria (1305-8), both connected with the Arpadian house. Pope Boniface VIII. and the bishops successfully espoused the cause of Charles Robert of Anjou, nephew of the king of Naples, and related to the extinct dynasty through his mother, a daughter of Stephen V. Under Charles and his son Louis, which latter in 1370 succeeded Casimir III. on the throne of Poland, Hungary made great progress both at home and abroad. During the reign of Louis it became the most formidable state in Europe. Among many other territories he conquered Moldavia (1352) and Bulgaria (1365); he also greatly extended and developed the royal prerogatives in his own king-

dom. Upon the death of Louis (1382), the states raised to the throne his daughter Maria, who, after the assassination of the pretender Charles II. (1386), reigned conjointly with her consort Sigismund of Brandenburg, son of the emperor Charles IV. In the early part of this reign the Turks under the sultan Bajazet infested some of the Hungarian provinces, and at length in 1396 utterly defeated Sigismund at Nicopolis, obliging him to fly the kingdom. During his absence a party headed by the palatine Gara raised the standard of rebellion, and upon his return deprived him of his liberty. Scarcely was he released when he met with a rival in Uladislaus, king of Poland, who had married Hedwig, second daughter of Louis. Elected emperor (1411), and afterward king of Bohemia (1419), Sigismund, instead of providing for the safety of the country, employed his time in persecuting the Hussites. He ended his long and troublous reign December 9, 1437, and was succeeded by his son-in-law Albert, archduke of Austria.

The year 1439 witnessed the sudden death of Albert; his widow, however, was soon delivered of a son, Ladislaus Posthumus. The states invited Uladislaus of Poland to the throne, and thus considerable dissensions existed until the death of the queen in 1442, when the party of Uladislaus secured his accession. At the commencement of his reign the Turks were several times defeated by John Hunyady (Corvinus), and they were at length forced to conclude a truce for ten years. The Hungarians, having almost immediately broken faith with the Turks, and taken the field against them, were completely routed at Varna on November 10, 1444. In this battle Uladislaus met his end, while Hunyady escaped with a few followers. Amid the troubles which ensued the states proclaimed Hunyady "governor of Hungary" pending the absence of Ladislaus Posthumus, whom the emperor Frederick III. refused to deliver to the Hungarians to be acknowledged king. After the release and recognition of Ladislaus in 1452, Hunyady resigned the office of governor, and was nominated generalissimo by the king.

After the fall of Constantinople in 1453, Mohammed II. made preparations for the conquest of Hungary, and in 1456 appeared before Belgrade with an army of 150,000 men. This force was, however, utterly routed on July 21, 1456, by the combined Hungarian, Italian and Spanish troops, in all about 70,000 men, under the command of John Hunyady and the monk John Capistran. Soon after this victory, which resulted in the Turks raising the siege, Hunyady succumbed to dysentery aggravated by excessive fatigue, leaving behind him two sons, Ladislaus and Matthias. The former was executed by order of Ladislaus Posthumus, while the latter, after that monarch's death in November, 1457, being supported by a strong party under the leadership of his uncle Michael Szilágyi, was elevated to the royal dignity on January 24, 1458, under the title of Matthias I. The emperor Frederick, having disputed his right to the throne, and assumed the regal title himself, was forced by Matthias to surrender all claims to the Hungarian dominions, and to conclude a peace in July, 1463. During the next few years Matthias was employed in reorganizing the military system and repelling the Turks. He after this turned his arms against Podiebrad, king of Bohemia (1468), ostensibly for the purpose of defending the Catholics against the Hussites. Being victorious in these campaigns, Matthias, in May, 1469, caused himself to be proclaimed king of Bohemia and Moravia at Olmütz. Meanwhile the Turks, taking advantage of the absence of the king, made incursions into the southern provinces of Hungary. This misfortune created a party against Matthias, who, having returned to Hun-

gary and restored order, marched against the Ottoman forces, and totally defeated them in a sanguinary battle on the plains of Kenyérmező in Transylvania (November 13, 1479). After the death of Mohammed II. in 1481, Matthias renewed hostilities with the emperor Frederick, and, having taken Vienna (1485), made it the seat of his government. Matthias was not only an able and warlike monarch, but a patron of letters, and administered his kingdom with impartiality, subduing the rebellious nobles, and restoring order, law and prosperity.

At the death of Matthias, April 6, 1490, there were several pretenders to the throne, among them John Corvinus, a natural son of the late king, the emperor Frederick, and his son Maximilian. But the states disallowed their claims, and declared for Uladislaus of Bohemia, whose weak reign is marked chiefly by the insurrection of the peasantry in Transylvania, under Dózsa, which was suppressed with great bloodshed in 1514, as also for the collection made by Verböczy of the common laws of the realm, entitled "*Tripartitum Opus Juris Consuetudinarii Inclyti Regni Hungariæ*," which code was sanctioned by the king and the diet in 1514. Under this monarch and his son Louis II., who succeeded him, the power of Hungary rapidly declined, and it was at length utterly overthrown by the Turks under Soliman the Magnificent. This powerful ruler, having captured Belgrade and Peterwardein, advanced at the head of 200,000 men into the interior of the country, and annihilated the Hungarian army at the battle of Mohács, August 29, 1526. In the carnage several prelates and the flower of the Hungarian nobility were destroyed, and Louis himself perished in his flight. The Ottomans, after pillaging Buda and spreading devastation over the whole country, took their departure with many thousands of captives.

After the catastrophe at Mohács and death of Louis in 1526, a portion of the nobles declared for John Zápolya, waywode of Transylvania, who was accordingly crowned at Székesfehérvár (Stuhlweissenburg). Maria, the widow of Louis, immediately summoned a diet of the nobility of the western counties at Pozsony (Pressburg), who pronounced the election of Zápolya illegal, and proclaimed the queen's brother, Ferdinand of Austria, king of Hungary (December 16, 1526). In the following August Ferdinand, having proceeded to Hungary, was again proclaimed king at Buda; he was afterward crowned at Székesfehérvár, November 5, 1527. With this monarch the Hapsburg period commences, the sovereign rulers of Austria after him succeeding to the title of the Hungarian crown.

John Zápolya, being compelled to retire before the superior forces of Ferdinand, took refuge for a time in Poland, whence he sought the assistance of Soliman II. The sultan listened to his request, and, in 1529, conducted a large army into Hungary, took Buda by storm (September 3d), reinstated Zápolya, and drove the Austrians before him to Vienna. Failing to take that city, Soliman, in October, retraced his steps, and, after garrisoning Buda with Turkish troops, returned in triumph to Constantinople. After several years of desultory warfare between John and Ferdinand, their rival claims were ultimately settled by a treaty concluded at Nagyvárad (Grosswardein), February 25, 1538. By this treaty it was stipulated that John was to retain the title of king, together with Transylvania and the eastern portion of Hungary then in his possession, while Ferdinand was to hold the remainder, with the proviso that John's male descendants were to surrender all claims to the regal dignity. John having died July 21, 1540, his infant son, Sigismund, was crowned by the adherents of his father, and he was subsequently confirmed in his title to Transylvania by Soliman. This sultan, however, retained a

great portion of Hungary in his own possession, and even placed a pasha as regent at Buda; he, moreover, compelled Ferdinand to pay him an annual tribute of 30,000 ducats. Ferdinand, having caused his son Maximilian to be crowned as his successor in 1563, died on July 25th of the following year. When Maximilian succeeded to the throne, he found himself obliged to continue the war with the young Zápolya, whose cause was espoused by Soliman. In 1566 the sultan, advancing at the head of a large force, was arrested at the small fortress of Sziget by Nicholas Zrinyi, who, with a garrison of 3,000 men, for four weeks heroically defied the whole power of the besiegers. Soliman himself died shortly before the final assault on the citadel, which was overpowered only after the destruction of a large part of his army. In the year 1570 Zápolya concluded peace with Maximilian, and, on his death in the following year, Stephen Báthori, with the consent of the sultan Selim, was elected prince of Transylvania. Maximilian, having, in 1573, secured the succession of his son Rudolph to the throne of Hungary, died October 12, 1576.

By this time the Reformation had made considerable progress in Hungary, more especially among the higher classes, but with Rudolph the persecution of the Protestants commenced. In Transylvania, however, they met with a protector in Stephen Báthori, from 1576 to 1586 distinguished as king of Poland. In 1604 the Protestants of Hungary, having raised the standard of freedom under Stephen Bocskay, defeated the generals of Rudolph in several engagements, and on June 23, 1606, they forced him to conclude peace at Vienna, thus securing to themselves for a time their religious liberties. In 1608 Rudolph resigned the kingdom to his brother Matthias, who, during his short reign, showed great toleration toward the adherents of the Reformed creeds. He died March 20, 1619, leaving the crown to his cousin Ferdinand II., the hero of the "Thirty Years' War." The accession of this monarch was signalized by the insurrection of the Protestants of Bohemia, and the renewal of persecutions in Hungary, fomented by the Jesuit prelate Peter Pázmán. But the victories of the Transylvanian prince Bethlen Gábor (Gabriel Bethlen) over the imperialist troops forced Ferdinand to conclude the treaty of Nikolsburg, December 31, 1621. By this compact the privileges of the Protestants were declared inviolate, and Bethlen's claim to the principality of Transylvania and seven counties of Hungary Proper was established. The infringement of this treaty on the part of Ferdinand brought about a renewal of hostilities, which resulted in a second peace, concluded at Pozsony (Pressburg) in 1626. After the death of Bethlen in 1629, the Jesuits succeeded in gaining over several powerful families to the Roman Church, and the religious persecutions were renewed by Ferdinand III., who succeeded his father in 1637. The Transylvanians had elected George Rákóczy as their prince, who proclaimed himself the protector of Protestantism and of Hungarian liberty. Having drawn up a statement of grievances—those of the Protestants in particular—he laid the document before Ferdinand, who, however, paid no attention to it. Rákóczy thereupon collected troops and gained several successes over the imperialists (1644), and in the next year formed a league with the Swedes. This coalition brought Ferdinand into desperate straits, and he therefore soon entered into a treaty of peace with Rákóczy at Linz (December 16, 1645). By this treaty, confirmed at the diet held in 1647, Rákóczy was formally recognized as the legitimate prince of Transylvania. He died the year afterward (1648), and was succeeded by his son George II. Rákóczy. The year 1657 witnessed the death of Ferdinand III., who was succeeded by his second son, Leopold I.

During the long reign of this monarch, so injurious to the cause of Hungarian liberty, Hungary was the theater of intestine wars, insurrections, and the most tragic events. Shortly after his accession, Leopold became involved in war with the Turks, who had created Michael Apaffi prince of Transylvania in the place of his own partisan John Kemény. The Turks, although at first successful, were ultimately defeated by the imperialists at St. Gotthard, August 1, 1664. This victory enabled Leopold to conclude a hasty and disadvantageous peace at Vasvár (August 10th) with the infidels, and to direct his whole energies against the Protestants. The irritation consequent upon this harsh treatment resulted in a conspiracy, which was organized by the Croatian ban Peter Zrinyi, Count Frangepan, Francis Rákóczy, and the chief justice Nádasdi, and had for its object the separation of Hungary from the house of Hapsburg. The plot having been discovered, the leaders were surprised, conveyed to Vienna, and, with the exception of Rákóczy, executed (April 30, 1671). Although an amnesty was proclaimed on June 6th, of the same year, Leopold in February, 1673, appointed a bigoted Catholic, John Caspes Ambringen, governor-general of the kingdom, and made every effort to extirpate the Protestant religion. The oppression becoming at last intolerable, the Protestants again rose in arms under Michael Teleki and Emeric Tökölyi (1678), and were subsequently supported by the grand vizier Kara Mustapha, who in 1683 marched straight to Vienna with a large force. The valor of Sobieski, king of Poland, delivered the city (September 12, 1683), and saved Austria from the threatened destruction. In 1686 Buda was taken from the Turks by Charles of Lorraine, and these troublesome foes were at length driven out of most of the provinces and towns of Hungary where they had been settled for about a century and a half. The glory of these achievements was, however, tarnished by the emperor's revengeful treatment of the Hungarians, hundreds of whom, on suspicion of complicity with the enemy, were put to death upon the scaffold erected in the market-place of Eperies by order of General Caraffa, which remained standing from March, 1687, till the end of the year. Leopold at length granted a general amnesty, but obliged the diet to declare the throne hereditary in the house of Austria, and to abrogate the clause of the Golden Bull which allowed the right of armed resistance to tyranny (October 31, 1687). The victories of Prince Eugene, which completed the conquests over the Turks, resulted in the peace of Carlowitz, January 26, 1699, by which the Porte abandoned Hungary and Transylvania to the emperor. On May 5, 1705, Leopold died, and was succeeded by his eldest son Joseph I. In the year 1703 Francis Rákóczy II. headed a new revolution, which lasted till May, 1711, when peace was concluded at Szatmár by Károly, the chief of the Hungarian generals. The emperor Joseph I. died on April 17th of the same year, and was succeeded by his brother, the archduke Charles. From this time until 1848 no open rupture occurred between Hungary and her Hapsburg rulers.

By the treaty of Passarowitz, concluded July 21, 1718, Temesvár, the last of the Turkish possessions, reverted to Hungary. In 1722 Charles received the adhesion of the diet to the Pragmatic Sanction, which secured the right of succession to the throne in the female line. At the instigation of Russia hostilities were renewed against the Turks, but Prince Eugene being now dead, and no other leader of equal ability appearing in his place, the Austrians were subjected to a series of disgraceful defeats. These misfortunes were consummated by the humiliating treaty of Belgrade (September 18, 1739), in accordance with which the emperor was forced to cede the

fortress of Belgrade, with Servia and Austrian Wallachia. On October 20th of the following year Charles died, leaving the throne to his daughter Maria Theresa. Her claims to the imperial dignity were almost immediately called in question by Prussia, Saxony, France and Bavaria, and her hereditary dominions were invaded by hostile troops. Maria, in despair, fled to Pozsony (Pressburg), and summoned the Hungarian diet. Appearing before that assembly on September 11, 1741, with her infant son Joseph in her arms, she appealed in Latin to the magnanimity and loyal spirit of the nobles. The result of her address was the unanimous declaration on their part: "Moriatur pro 'rege nostro' Maria Theresa." Nor was this an empty burst of enthusiasm, for the "insurrectio," or general rise of the nation was proclaimed, and a large army collected, and Hungarian blood was profusely shed in support of her cause. Maria repaid the devotion of her subjects by the zeal which she showed for their welfare, and the salutary changes which she effected in the country. Transylvania was raised into a grand-principality (1765), and the town and district of Fiume declared a *corpus separatum* of the Hungarian crown (April 23, 1779). Maria Theresa also created an Hungarian guard, established several schools, and enlarged the university at Nagyszombat (Tyrnau), which, in 1777, was transferred to Buda, and seven years later to Pest. But her efforts to ameliorate the condition of the peasantry, and the reforms which she introduced under the name of the *Ubarium* (1765), which determined the rights of the tenant serfs in relation to the landowners, are among the chief merits of her reign. She died November 29, 1780, and was succeeded by her son, Joseph II.

This philosophic monarch was wholly carried away by his zeal for reforms, which were both subversive of the constitution and opposed to the will of the nation. He refused to be crowned in Hungary, and thus avoided the obligations of the usual coronation oath. In defiance of ancient custom, he carried the crown of St. Stephen to Vienna, dispensed altogether with the use of diets, and governed the country autocratically by decrees. He issued a general edict of toleration in religious matters (October, 1781), but forced upon the people heavy taxes and foreign officials; he, moreover, enjoined the exclusive use of the German language in the schools, courts of justice, and public administration. The general discontent at these measures was heightened by the unfavorable issue of the war against Turkey; and Joseph, shortly before his death (1790), found himself compelled to revoke nearly all his edicts, and promise redress to his irritated subjects. His brother and successor, Leopold II., appeased the Hungarians by more definitely confirming the rights and liberties of the nation than any of his predecessors. After a reign of only two years, Leopold died, and was succeeded by his eldest son, Francis I. (1792). This monarch duly swore to maintain the laws and constitution of Hungary, but his efforts were eventually directed wholly against them. During the continuance of his war with France, he repeatedly convoked the states, only, however, for the purpose of obtaining supplies of men and money to carry on the struggle. Through the whole of this crisis the Hungarians faithfully supported the Austrian cause, and disdainfully rejected the offers of Napoleon in his proclamation of May 15, 1809, calling upon them to rise for national independence. But at the end of the great war the Hungarian nation received little gratitude for its devotion. Francis for several years discontinued the holding of the diet, and acted in direct violation of the constitution by levying troops and increasing the taxation to more than double. The opposition which these arbitrary measures provoked in the counties at length

obliged him, in 1825, to convene the states, and thus appease the widespread dissatisfaction.

To the holding of this diet, in which Count Stephen Széchenyi initiated the use of the Magyar instead of the accustomed Latin tongue, may be traced not only a reaction in favor of the native language, but also the commencement of the reform movement. The spirit of nationality was fully aroused, and liberal sentiments were diffused over the whole kingdom, notwithstanding the active opposition of the Viennese court influenced by Metternich, in the reigns of both Francis and his successor Ferdinand (1835). The diets of 1832, 1839, and 1843 passed several measures of reform, among which the most important were those demanding the official use of the Magyar language, the equality of the various Christian confessions and the rights of the peasantry and of the non-ennobled citizens. Among the leaders of the liberal party the magnates were Count Louis Batthyányi and Barons Nicholas Wesselényi and Joseph Eötvös, and the deputies Deák, Klauzál, Fáy, Beöthy, Balogh, Szemere, and Louis Kossuth. In the hope of intimidating the advanced liberals, the Viennese court in 1839 imprisoned Wesselényi and Kossuth, but they were released in 1840 owing to the amnesty then proclaimed for political offenders. The publication of the *Pesti Hírlap* (Pest Gazette) was commenced in 1841 by Kossuth as the organ of the liberal party. This paper, the leading articles of which were written in a spirit directly opposed to the policy of the government, gained an immense circulation, and considerably influenced the public mind. A pamphlet styled *A Kelet Népe* (The People of the East), written by Széchenyi in order to counteract the schemes of Kossuth, only served to add to the importance of the *Pesti Hírlap*. The conservative journal *Világ* (Light) was conducted by Count Aurél Dessewffy, who from 1833 until his death in 1842 was the leader of the conservative party.

Meanwhile intellectual and material improvement made rapid progress, especially in the Hungarian capital. Numerous works, literary and political, were published, the former due to the encouragement offered by the Hungarian academy and the Kisfaludy society, but the latter the outcome of great political excitement prevailing throughout the country. Clubs really if not avowedly political were established in most of the principal towns. Steam navigation of the Danube, the Budapest suspension bridge (commenced May, 1840), and other improvements of the means of internal communication, which had received their first impulse from Count Széchenyi, were rapidly proceeded with. In order to encourage native trade and industry, long obstructed by toll and custom duties, Kossuth called into existence the *Védegylet* (Protection Union), the members of which pledged themselves to abstain from the use of Austrian manufactures until the tariff should be reformed. This association soon overspread the country, and affected Austrian trade so seriously that some manufacturers had to transport their factories into Hungary in order to save themselves from ruin. The establishment of this association, the liberal measures of the late diets, and the unanimity of national feeling in Hungary Proper and Transylvania embarrassed the government of Vienna, which could reckon only on the support of the Conservatives, whose numbers and moral influence were comparatively small. Metternich therefore determined to annihilate the municipal independence of the counties, in whose assemblies lay the real strength of the Liberals, by the appointment of "administrators" paid by the court to fill the places of all absent lord-lieutenants. This measure raised the political excitement of the nation to the highest pitch. The Liberals were soon divided into two

parties, the so-called "municipalists," with Kossuth at their head, who urged the reaffirmation of the county institutions, and the "centralists," led by Szalay and Eötvös, who insisted upon the nomination of a responsible ministry. On the approach of the elections for the diet of 1847 these two parties agreed upon a common course of action. In November the diet was summoned, when Kossuth appeared as a candidate for the county of Pest, and after a warm contest was elected. On November 12th the diet was opened at Pozsony (Pressburg) by Ferdinand V. in person, who by addressing the assembled states in the Magyar language instead of Latin produced a very favorable impression. The first act of the diet was the unanimous election of a successor to the late palatine Joseph in the person of his son the archduke Stephen. Thus far all was well, but the address to the throne containing clauses inserted by Kossuth's party, deprecatory of unconstitutional measures by the government, after passing the lower was rejected by the upper house, by which means the royal speech was practically ignored. At the commencement of the year 1848 an act was carried through both houses, ordaining the exclusive use of the Magyar language in all branches of the administration, in legal documents, and in the schools and colleges. Certain provisions were, however, made respecting Croatia and Slavonia.

Upon the news of the French revolution the diet was powerfully impressed, and the Liberals assumed a more determined attitude. On the proposal of Kossuth it was unanimously resolved to send a deputation to Vienna demanding from the government a responsible ministry, the abolition of all feudal burdens, the equalization of taxes, the extension of the franchise, freedom of the press, complete religious toleration, and several other measures of reform. On March 16th, the address was presented to Ferdinand, who, by reason of the troubled state of his Italian provinces and the revolutionary aspect of Vienna, was compelled to yield his assent. The palatine archduke Stephen was nominated viceroy in Hungary, and Count Louis Batthyányi intrusted with the formation of a ministry. The irritation of the Viennese Government at this enforced compliance with the Hungarian demands was increased by the choice of Kossuth as minister of finance. On April 11th Ferdinand repaired to Pozsony (Pressburg), and the diet was closed with a Magyar speech from the throne.

But the Austrian Government, although compelled to abandon for the present its position of open and direct hostility to the national will of the Hungarians, was determined by other means to prevent the new reforms from being carried out. The plan adopted was that of secretly encouraging the southern non-Magyar nationalities to assert their independence, and oppose by force of arms the consolidation of the new constitution. Croatia and Slavonia and the Bánát refused to submit to the Hungarian rule, and demanded separate rights and autonomous administration; while in Transylvania, the diet of which had proclaimed its reunion with Hungary Proper, the Wallachs and Saxons rose in arms against the Magyars. The whole of the south and southwest of the country was soon in a state of revolt, and a war of races was carried on with indescribable fury. Representations to the court of Vienna remained virtually unheeded, the emperor contenting himself with hypocritical proclamations against the rebels, and with placing at the disposal of the Hungarian ministry a few regiments of soldiers, whose officers were disaffected to the Hungarian cause.

It now became evident that the Hungarians, in order to retain their national existence, must rely entirely upon their own resources, and make an immediate and vigorous effort, more especially as Jellachich, the newly

appointed ban of Croatia, was making preparations to march upon Pest. Ferdinand, who still professed his determination to defend the integrity of the Hungarian monarchy, convoked the diet for July 5th, when it was opened by the palatine Stephen, as viceroy. At the suggestion of Kossuth a levy of 200,000 men and ample supplies for the purposes of national defense were unanimously voted; but to these measures Ferdinand withheld his assent. On September 6th a deputation of 100 members arrived at Vienna in order to urge upon the emperor the necessity of taking immediate and decisive steps to oppose the Croatian invasion. On September 9th they were admitted to an audience, but, receiving only an evasive answer, they straightway returned to Pest. The abortive result of the deputation, and an official report that Jellachich had crossed the Drave, were announced to the diet on September 11th, and brought matters to a crisis. A few days later the palatine archduke Stephen, who at the demand of the diet had set out for the camp, but failed in his efforts at mediation, fled to Austria. The emperor thereupon nominated Count Lamberg royal commissioner and commander-in-chief of all the military forces in Hungary (September 25th), but the diet pronounced his appointment illegal and invalid, and he was murdered on the Budapest bridge of boats by the infuriated populace (September 28th). The Batthyányi ministry now resigned, and a committee of national defense was formed under the presidency of Kossuth. On September 29th, Jellachich, who had advanced to within twenty-five miles of Buda, was defeated at Velence, whence he fled toward Vienna during a three days' armistice that was granted to him by General Mőga. Ferdinand now declared openly against the Hungarians, annulled the decrees of the diet, and nominated Jellachich generalissimo of the forces to be employed for the reduction of Hungary. While the Austrian Government, still further exasperated at the march of a Hungarian force to Schwechat (October 30th), was preparing for a general invasion, the Hungarian diet hastily equipped a large army to resist it. In the meantime a new Austrian ministry was formed at Vienna, and on December 2d Ferdinand was induced to resign the imperial throne. He was succeeded by his nephew, archduke Francis Joseph, son of Francis Charles, the heir-apparent, who refused to accept the crown. The Hungarian diet, however, protested against this dynastic change as unconstitutional.

On December 15th, the main body of the Austrian army under Prince Windischgrätz began to cross the western frontier of Hungary near Bruck on the Leitha, while the Hungarian army of the Upper Danube, commanded by Görgei, who had succeeded Mőga, retreated in the direction of Moson (Wieselburg). On December 18th, the second Austrian army corps occupied Pozsony (Pressburg), which the Hungarian troops had evacuated, and upon the same day Jellachich, who commanded the first army corps, occupied Moson, compelling Görgei to withdraw toward Győr (Raab). Upon the occupation of this town by the Austrians, on December 27th, Görgei removed to Bábolna, where he hoped to effect a junction with Perczel, who had been ordered to reënforce him. But Perczel, being overtaken and defeated at Móor on December 29th, by the troops of the ban, was obliged to beat a hasty retreat toward Székesfehérvár (Stuhlweissenburg). These reverses having rendered Budapest insecure, the diet and the committee of national defense on January 1, 1849, transferred their seat to Debreczen, and on the night of the 4th and 5th the Hungarian troops marched out of the capital, which on the following day was taken possession of by Windischgrätz. Perczel, who had

gathered together the remains of his corps at Budapest, followed the government by way of Szolnok, while Görgei made a flank movement to the north and led his corps by a circuitous route through the Carpathians to join the army on the Theiss. Windischgrätz, mindful of Schwechat, and regarding the Hungarians as rebels, had refused to listen to a deputation headed by Count Batthyányi making proposals of peace, and Batthyányi himself was arrested. While the Austrian generals were making this rapid progress in Hungary Proper, the Polish general, Bem, had succeeded in organizing a large force in Transylvania, by means of which he reduced the refractory Wallachs to subjection, and drove the Austrians out of the principality, which had been forced to submit to General Puchner.

In the diet now held at Debreczen, Kossuth declared that the nation was on the verge of destruction, and could only be saved by extraordinary measures. But the inactivity of Windischgrätz, who, instead of hastening onward to the Theiss, remained for several weeks at Pest, gave the committee of national defense time to concentrate its forces, procure war material, and make other provisions for a determined resistance. On February 12th, Görgei arrived at Kassa (Kaschau), and the two Hungarian armies could now act in concert. Meanwhile the national cause made little progress in the south, a great portion of which was in the hands of the enemy. On February 14th, the fortress of Eszék in Slavonia was lost to the Hungarians; that of Lipótvár (Leopoldstadt) in the north had already fallen on the 2d of the same month.

At length the main body of the Austrians under Windischgrätz advanced, and attacked the Hungarians under the Polish general, Dembinski, on February 26th and 27th at Kápolna. The battle, though obstinately contested, proved indecisive, and the Hungarians were obliged to retire beyond the Theiss in order to recruit their forces. A few days later, however, an Hungarian corps, withdrawn from the lower Danube, and commanded by Damjanics, routed the Austrians under Grammont at Szolnok (March 5th). Meanwhile the Russians, coming to the aid of the Austrians, had penetrated into Transylvania and occupied Nagyszeben (Hermannstadt) and Brassó (Kronstadt), but the Hungarians under Bem regained these fortresses on March 11th and 20th, and drove the Russians into Wallachia.

By the middle of March an army of 120,000 men, provided with excellent generals and ample artillery, was concentrated on the Theiss. Toward the end of the month the Hungarians crossed the river at various points, and advanced on the road to Pest, under the command of Görgei, Damjanics, Aulich, Klapka and others—Guyon having been nominated to the commandership of Komárom (Komorn), the relief of which was the ultimate object of the campaign. The leadership of the Hungarian forces had meanwhile passed from Dembinski to Vetter, on account of whose ill-health it was provisionally transferred, March 31st, to Görgei. From this time the Austrians had to endure a rapid succession of defeats—at Hatvan (April 2d), Tápió-Bicske (April 4th), Isaszeg (April 6th), Gödöllő (April 7th), and Vác or Waitzen (April 10th). In consequence of these reverses Windischgrätz was recalled, and the chief command of the Austrian troops was given to Baron Welden (April 12th). In order to prevent the relief of Komárom, Welden opposed the advance of Görgei with a force under Wohlgemuth, which was, however, defeated by Damjanics April 19th, at Nagy-Sarló, so that on the 22d the relief of the fortress of Komárom was effected upon the left bank of the Danube, Guyon having previously succeeded in passing through the hostile lines. The subsequent rout of the

besieging forces at Uj-Szöny, April 26th, completed the discomfiture of the Austrians, and forced them to fly to the frontier. The ban Jellachich meanwhile retreated to Croatia, and nearly the whole country was once more in the hands of the Hungarians.

In the midst of these victories Kossuth proposed in the diet at Debreczen the dethronement of the Hapsburg dynasty, and upon April 14th an act to that effect was almost unanimously passed, although afterward unfavorably received by Görgei and a large portion of the army. The chief provocation to the passing of this extreme and, as it eventually proved, unfortunate measure was the promulgation of the new constitution, March 4th, by the emperor Francis Joseph, which made a *tabula rasa* of all the time-honored laws, rights, and privileges of Hungary. The substance of the declaration of independence was as follows: "That the house of Hapsburg, having violated the integrity of the kingdom, treacherously levied war against the nation, and called in the aid of a foreign power to accomplish its aims, has trampled under foot all the treaties that united it to Hungary, and is therefore declared forever excluded from the Hungarian throne." The form of government was to be settled afterward by the diet, but in the meantime Kossuth was nominated governor, the committee of national defense was dissolved, and a new responsible ministry formed under the presidency of Szemere.

It is generally admitted that, had the Hungarians followed up their victories by an immediate march upon Vienna, they would have been able to force the Austrian Government to terms, and thus have warded off the Russian invasion, the preparations for which were now being conducted upon an enormous scale. Instead, however, of acting on the offensive across the Austrian frontier, the Hungarian commander-in-chief, Görgei, after a few days' delay at Komárom, made a retrograde movement toward the Hungarian capital. On May 4th he arrived before Buda, which was still in the possession of the Austrians, but it was in vain that he summoned the commander Hentzi to surrender. On the 15th began the regular bombardment of the fortress, and on the 21st it was taken by assault. On June 5th, Kossuth made his entry into Pest, and the diet having adjourned its sittings at Debreczen, the government returned to the capital. Every preparation was now set on foot for a desperate defense against the combined armies of Russia and Austria, which by the middle of the month had completed their arrangements, and had begun to invade the country at various points. Prince Paskewitch advanced from Galicia at the head of the main body of the Russian army, consisting of over 100,000 men, while Haynau crossed the western frontier with an Austrian force of 60,000, supported by a Russian division of 12,000 under Paniutin. On the Drave and the Styrian frontier Nugent commanded 12,000, and near Eszék was Jellachich with 25,000 men. In Transylvania the combined Austrian and Russian forces under Puchner and Lüders amounted to 60,000; so that, including the garrisons of the fortresses in their hands, the allied forces were in all not less than 275,000 men with 600 guns. The whole available forces of Hungary did not amount to more than half this number. The army of the Upper Danube under Görgei being 50,000, that of Perczel and Vécsey in the south 30,000, the army of the north under Dembinski 12,000; while there were about 32,000 men under Bem in Transylvania, and a few thousands under Kacinczy in the county of Máramaros. On June 19th the Russian corps under Lüders burst through the Red Tower Pass into Transylvania, and, having defeated the Hungarians, took the fortress of Nagy-Szeben, while in the following month Brassó in like manner surrendered to the

Austrians. Jellachich was, however, defeated on July 14th at Hegyes, and forced to retire from the Bácska. In the meantime Haynau's operations on the Danube met with general success, while the Russian main army advanced over Eperies and Kassa into the interior of the country. These disasters to the Hungarian cause were aggravated by the want of unanimity between the Hungarian commander-in-chief and the government, which, being again obliged to leave Pest, transferred its seat to Szeged (July 11th). After various sanguinary engagements with the invading forces in the vicinity of Komárom, Görgei on the night of July 12th left the fortress under the charge of Klapka. On the 15th and 17th Görgei encountered the Russians at Vác, and proceeded thence over Vadkert, Losoncz, and Rimaszombat, where on the 21st the Russian offers of truce were refused. Görgei, closely followed, finally crossed the Theiss on July 28th near Tokay, whence he proceeded in direction of Nagyvárad (Grosswardein) by routes to the east of Debreczen. There, on August 2d, his first army corps under Nagy Sándor was defeated by the troops of Paskewitch. The government had meanwhile removed to Arad, which fortress, having previously surrendered to the Hungarians, was made the last point of general concentration. In Transylvania the army of Bem had been overpowered on July 31st at Segesvár (Schässburg); and in Hungary Proper Dembinski retreated first to Szeged and Szöreg, whence he was repulsed on August 5th by Haynau, and afterward to Temesvár. There on the 9th he suffered an overwhelming defeat. Upon the news of this catastrophe reaching Arad on the night of the 10th to 11th, Görgei, who had already arrived there on the 9th by forced marches from Nagyvárad, induced Kossuth and the few ministers who were with him to lay down their authority, and upon the 11th received from them the supreme civil and military command. On the evening of the same day, after the departure of Kossuth for Lugos, the new dictator, believing further resistance hopeless, communicated with the Russian general Rüdiger, offering to surrender at discretion. The sally of Klapka from Komárom, and his signal victory over the besieging Austrian army (August 3d), were unknown at Arad. On August 13th Görgei surrendered his army, consisting of some 24,000 men with 140 guns, to Rüdiger at Szöllös near Világos; on the 16th Kazinczy followed with his troops, and on the 17th Damjanics gave up the fortress of Arad, and on September 5th a similar fate befell Peterwardein.

A few thousand men followed Bem and Guyon to Turkey, whither Kossuth and the late ministers Szemere, Casimir Batthyányi, and Mészáros, and the military leaders Dembinski, Vetter, Perczel, Kmetty, and Wysocki also escaped. On October 2d to 5th Komárom capitulated on honorable terms, General Klapka having refused to surrender until an amnesty and free passports had been granted by the Austrians. On October 6th Aulich, Damjanics, Dessewffy, Kiss, Knézich, Lahner, Lázár, Leiningen, Nagy-Sándor, Pöltenberg, Schweidel, Török, and Vécsey met their end at Arad. On the same day Count Louis Batthyányi, and subsequently Prince Woronieczki, Baron Jeszenak, Csányi, Perényi, and others suffered at Pest. By a decree of Haynau, to whom the Russians had delivered up the prisoners of war, all officers below the rank of general, if not consigned to prison, were pressed as privates into the Austrian service. The Hungarian commander-in-chief Görgei, however, was pardoned, and interned at Klagenfurt in Carinthia.

Hungary now lay entirely prostrate, and was treated as a conquered country. The Russians retreated to the north and east, leaving the Austrians with their commander, Haynau, who availed himself of the summary

powers conferred on him by the state of siege, to inflict the greatest cruelties on the vanquished people. Many of the Hungarian nobility were condemned to long terms of imprisonment; the estates of the richer patriots were confiscated; and numerous Austrian and Bohemian officials were thrust upon the exhausted country. A rigorous censorship of the press was at the same time enforced. At length, in July, 1850, Haynau was removed from the chief authority. A milder régime was inaugurated by the archduke Albrecht, who arrived at Pest on October 14, 1851, as the new civil and military governor. But it was only after the visit of the emperor to Hungary (June 5 to August 14, 1852), that the military courts were closed. The whole country, now reduced to a province of the Austrian empire, was placed under the direct control of the central government at Vienna. On May 1, 1853, the new organization was carried into effect, and the Austrian civil code made applicable to Hungary. On September 8th, the Hungarian insignia of royalty, which had disappeared from Arad at the time of Kossuth's flight, were discovered in the neighborhood of Orsova; they were conveyed on the 19th to Vienna, but were afterward transferred to Buda. On April 17, 1854, the state of siege was abolished, and on July 12, 1856, an amnesty was proclaimed. On May 4th of the following year the emperor visited Hungary, and on the 9th of the same month granted the restoration of their confiscated estates to late political offenders. In August he commenced a second progress through his Hungarian dominions, and availed himself of the opportunity to express his sentiments of consideration for the people.

Indeed, from this time (1857) both the emperor and the government of Vienna seemed desirous of making the Hungarians forget the troubles of 1848 and 1849 by concessions to the national will, while the encouragement given to improvements in the means of communication, and to the new projects for the regulation of the Theiss, as also the schemes for the colonization of sparsely populated districts, are well worthy of notice. During the year the railways from Szeged to Temesvár and from Szolnok to Debreczen were opened. By an imperial decree issued at the end of 1858 agricultural colonists, if of one nationality and creed, were allowed to settle in various parts of Hungary, with special exemptions from taxation. By a ministerial order of August 8, 1859, the language used in the higher schools was for the future to be regulated according to circumstances of nationality, the predominance of German being thereby abolished. On the 21st of the same month the absolutist minister Bach was dismissed, in consequence of the ill success of the Italian war, which was attributed to his ill-advised policy against the various nationalities of the realm. The so-called "Protestant patent" of September 1st, which ostensibly granted the communes the free administration of their own educational and religious matters, was, however, the cause of much dissatisfaction, and more than 2,800,000 Protestants petitioned for its withdrawal. In April, 1860, the archduke Albrecht was at his own desire removed from the civil and military governorship of Hungary, and the master of the ordnance, Benedek, a native Magyar, was appointed in his stead. The Hungarian members in the Reichsrath, specially summoned for the purpose of finding a definite form of settlement for the whole empire, now put forward claims for the autonomy of their country, and by an imperial diploma of October 20th their wishes were partly met. Benedek was removed from the general governorship of the kingdom; while the Hungarian court chancellery was restored, and Baron Vay nominated chancellor. At the same time the *curia regia* (supreme court of judicature) and the county assemblies were reinstituted, and

Magyar recognized as the official language. Furthermore, the emperor on December 27th granted the reannexation of the Temesvár Bánát to Hungary Proper. In the following February it was decreed that their former constitutions should be restored to Hungary, Transylvania, and Croatia and Slavonia, and on April 6th the diet met at Buda, afterward removing to Pest. But as the address sent to Vienna in June demanded the fullest autonomy for Hungary, and the Hungarians refused to yield their claims, in spite of the emperor's declared inability to accede, the diet was dissolved by imperial decree on August 22d. Meanwhile a new Hungarian court chancellor had been appointed in the person of Count Forgách. Stringent measures were taken by the government of Vienna to counteract the organized passive resistance of the counties, and in many places the payment of the taxes was enforced by military aid. On October 27th the holding of all public county meetings was forbidden, and administrators or coadjutors were in many counties thrust upon the lord-lieutenants, who were forced to submit to the authority of the newly appointed government superintendent, Count Pálffy de Erdöd. On November 18, 1862, a general amnesty was granted to those who were implicated by their hostility to the late government measures. In the summer of 1863 Hungary suffered from a severe famine, but the Reichsrath voted 20,000,000 florins to alleviate the distress. On April 22, 1864, Count Forgách was replaced by Count Arminius Zichy, who, on account of his unpopularity, was on June 26, 1865, removed for Count George Majláth, a Conservative. In a visit to Budapest, June 6 to 9, 1865, the emperor declared his willingness to do justice to the constitutional demands of the Hungarians, as far as was consistent with the integrity of the empire. On July 18th Count Pálffy de Erdöd was replaced by Baron Sennyey, one of the leaders of the old Conservative party. On December 14th the diet was opened by the emperor in person, who assented to the principle of self-government for Hungary, and agreed to recognize the Pragmatic Sanction as the basis of a settlement of the questions involved. The diet, however, demanded also an acknowledgment of the continuity of the constitutional rights of 1848. After the outbreak of the war between Austria and Prussia the diet was prorogued (June 26, 1866). Upon its reopening on November 19th an imperial rescript was read in which the emperor acquiesced in the Hungarian demands for constitutional self-government, and promised to appoint a responsible ministry. The result of the "compromise" effected by Baron Beust between the Austrian Government and the committee, headed by Deák, empowered by the Hungarian diet, was the dualistic system of the Austrian-Hungarian monarchy, as finally sanctioned, February 18, 1867. This arrangement secured to Hungary the restoration of the constitutional, legal and administrative autonomy of 1848, while the supreme command and direction of the army were assigned to the emperor-king. A responsible ministry, including Barons Wenckheim and Eötvös, Count Mikó, Melchior Lónyay and others, was formed February 20, 1867, under the presidency of Count Andrassy. On June 8th, following, the emperor and empress were crowned king and queen of Hungary at Budapest, and a complete pardon was proclaimed to all political offenders both at home and abroad.

The reconciliation of the Magyars with the Hapsburg dynasty being thus complete, both parties sought to throw a veil over the past by mutual concessions. Transylvania was incorporated with Hungary Proper, and a joint commercial contract was entered upon between Hungary and Austria. In like manner foreign affairs and joint finance were assigned to "common

ministries." On August 8, 1868, the Hungarian house of representatives accepted the dual government military scheme, by which the standing army remained under the direction of the imperial ministry of war. The *Honvéd* (home-defense) army obtained its own special organization and commander-in-chief. The long-existing misunderstanding between Hungary and Croatia was at length settled by the agreement concluded in September, which placed the relations of Croatia to the Hungarian crown on a more equable footing than hitherto. After the passing of various other measures of reform, including the emancipation of the Jews, a compulsory education act, and a special act (November 29th) for the consolidation of all nationalities under the crown of St. Stephen, the session of the Hungarian diet was closed on December 10, 1868. In the elections for the next session (1869-72) the Deák party, which had taken the lead in the previous diet, were returned by a large majority, and in the new diet, opened April 23, 1869, the policy of conciliation still prevailed. The ministry from time to time underwent certain modifications, owing to the death of Baron Eötvös, the minister of education (February, 1871), the appointment of Count Lónyay (May, 1870) to the imperial ministry of finance, and his subsequent nomination to the presidency of the Hungarian council in the place of Count Andrassy, who in November, 1871, succeeded Beust as foreign minister of Austria-Hungary. Meanwhile the finances of Hungary were becoming rapidly embarrassed owing to the repeated contraction since 1867 of enormous loans for state railways and costly public works. The elections of 1872 were, however, again favorable to the Deák faction. At the end of November Lónyay retired from the presidency of the ministry, and on December 1st was succeeded by Szlávy, who in March, 1873, obtained the consent of the diet to some additional taxes. In August the Military Frontier districts were placed under civil jurisdiction, the eastern portion or the Servian-Bánát frontier being incorporated with Hungary Proper. The new cabinet was not more fortunate than that which had preceded it in a solution of the financial question, and in March, 1874, made room for a coalition ministry under Bittó, with Ghyczy as finance minister. Upon its resignation in February, 1875, in consequence of the refusal of the house to grant further taxation, a strong liberal combination was formed by Tisza from members of the left and of the former Deák party. The new ministry, under the presidency of Wenckheim (March 3d), was supported by an overwhelming majority in the elections for the new session (1875-78). On October 16th Tisza, minister of the interior, was nominated president, and the financial difficulty was met by an advance in the income tax, and a fresh loan. The death of Deák, January 29, 1876, cast a gloom over the whole country. For some time previously he had withdrawn from the field of politics, where less moderate but more distinctly Magyarizing tendencies now prevailed. By its resolutions of March 24 and 27, 1876, the diet deprived of their former privileges the so-called "Saxon" sees and districts in Transylvania. From these new counties were formed on the system adopted for the rest of Hungary, and were placed under the general administration. The number of royal free towns in Hungary was, moreover, much reduced, especially in the Transylvanian circle. The insurrectionary state of the Slavic provinces of Turkey excited the apprehensions of the Magyars with regard to the Slav races of southern Hungary, and aroused a strong feeling of sympathy for the Porte. This was still further increased by the attitude of Russia, and the cordiality toward the Magyars evinced by the sultan Abdul Hamid II., who in 1877 presented the university

of Budapest with a portion of the remains of the library of Matthias Corvinus. During the course of the war between Turkey and Russia the Magyars were with difficulty restrained from open manifestations in favor of the former and against the latter power. Nevertheless, after the conclusion of peace, Hungary had, in conformity with the requirements of Art. XXV. of the Berlin Treaty (July, 1878), to furnish her quota of troops for the occupation of Bosnia and the Herzegovina, a task effected only with a considerable loss of men, and an additional burden on the state finances. The diet having been closed by the king on June 30th, the new elections were held at the time the struggle for the occupation of Bosnia was progressing. The popular excitement in Hungary Proper was very great, both on account of the losses suffered by the Hungarian troops and the destruction by a violent thunderstorm of the town of Miskolcz. On October 3d Széll, minister of finance, resigned office; other ministers also tendered their resignations, but were induced to retain their posts for a time. In the elections the majority of votes had fallen to the Liberal or Government party. On October 20th the Hungarian parliament was opened, and at the beginning of December the reconstruction of the ministry was completed, the only new members being, for finance, Count Szapáry, and for commerce Baron Kemény. On the 14th a sum of 20,000,000 florins was granted for the occupation expenses of the following year.

Early in the spring of 1879 the attention of all parties was for a time distracted from political matters by the disastrous inundation of Szeged. At the beginning of May the friendly relations of the non-Magyar nationalities of Hungary, and more particularly of the Roumanians of Transylvania, toward the Magyars seemed to be endangered by the passing of the amended education bill ordering the state language to be taught in all the non-Magyar primary schools. The new law, as affecting many nationalities, is likely to have an important bearing on the future of Hungary. The urgent necessity for more extended river embankments and a better system of dykes and dredging in the water-coursed levels of the midland Trans-Tisian counties became more than ever apparent in December, when inundations of the triple Körös and the Maros submerged many villages, farms, and pasturages, devastated large portions of Nagyvárád (Grosswardein), Arad, and other low-lying communes, and rendered thousands of persons homeless. In March, 1880, a loan of 40,000,000 florins was raised for the purposes of regulating the Theiss and the Maros, and of rebuilding and securing the town of Szeged.

HUNS. The authentic history of the Huns in Europe practically begins about the year 372 A.D., when under a leader named Balamir (or, according to some MSS., Balamber) they began a westward movement from their settlements in the steppes lying to the north of the Caspian. After crushing, or compelling the alliance of, various nations unknown to fame (Alpilzuri, Alcizuri, Himari, Tuncarsi, Boisci), they at length reached the Alani, a powerful nation which had its seat between the Volga and the Don; these also, after a struggle, they defeated and finally enlisted in their service. They then proceeded, after a short interval, in 374, to invade the empire of the Ostrogoths (Greuthungi), ruled over by the aged Ermanaric, or Hermanric, who died (perhaps by his own hand) while the critical attack was still impending. Under his son Hunimund a section of his subjects promptly made a humiliating peace; under Witthemir (Winithar), however, who succeeded him in the larger part of his domains, an armed resistance was

organized; but it resulted only in repeated defeat, and finally in the death of the king. The representatives of his son Witheric put an end to the conflict by accepting the condition of vassalage. Balamir now directed his victorious arm still further westward against that portion of the Visigothic nation (or Tervingi) which acknowledged the authority of Athanaric. The latter entrenched himself on the frontier which had separated him from the Ostrogoths, behind the "Greutung-rampart" and the Dniester; but notwithstanding all his precautions he was surprised by the enemy, who forded the river in the night, fell suddenly upon his camp, and compelled him to abandon his position. Athanaric next attempted to establish himself in the territory between the Pruth and the Danube, and with this object set about heightening the old Roman wall which Trajan had erected in northeastern Dacia; before his fortifications, however, were complete, the Huns were again upon him, and without a battle he was forced to retreat to the Danube. The remainder of the Visigoths, under Alavivus and Fritigern, now began to seek and ultimately were successful in obtaining (376) the permission of the emperor Valens to settle in Thrace; Athanaric meanwhile took refuge in Transylvania, thus abandoning the field without any serious struggle to the irresistible Huns. For more than fifty years the Roman world was undisturbed by any aggressive act on the part of the new invaders, who contented themselves with overpowering various other tribes which lived to the north of the Danube. In some instances, in fact, the Huns actually lent their aid to the Romans against third parties; thus in 404-5 certain Hunnic tribes, under a chief or king named Uldin, assisted Honorius in the struggle with Radagaisus (Ratigar) and his Ostrogoths, and took a prominent part in the decisive battle which was fought in the neighborhood of Florence. Once indeed, in 409, they are said to have crossed the Danube and invaded Bulgaria under perhaps the same chief (Uldis), but extensive desertions soon compelled a retreat. About the year 432, a noteworthy Hunnic king, Ruas or Rugulas, is mentioned, who made himself of such importance that he received from Theodosius II. an annual stipend or tribute of 350 pounds of gold (£14,000), along with the rank of Roman general. Quarrels soon arose, partly out of the circumstance that the Romans had sought to make alliances with certain Danubian tribes which Ruas chose to regard as properly subject to himself, partly also because some of the undoubted subjects of the Hun had sought and found refuge on Roman territory; and Theodosius, in reply to an indignant and insulting message which he had received about this cause of dispute, was preparing to send off a special embassy when tidings arrived that Ruas was dead, and that he had been succeeded in his kingdom by Attila and Bleda, the two sons of his brother Mundzuk (433). Shortly afterward the treaty of Margus (not far from the modern Belgrade), where both sides negotiated on horseback, was ratified. By its stipulations the yearly stipendium or tribute payable to Attila by the Romans was doubled; the fugitives were to be surrendered, or a fine of £8 to be paid for each of those who should be missing; free markets, open to Hun and Roman alike, were to be instituted; and any tribe with which Attila might be at any time at war was thereby to be held as excluded from alliance with Rome. For eight years afterward there was peace so far as the Romans were concerned; and during this period probably it was that the Huns proceeded to the extensive conquests to which the contemporary historian Priscus so vaguely alludes in the words: "He (Attila) has made the whole of Scythia his own, he has laid the Roman

empire under tribute, and he thinks of renewing his attacks upon Persia. The road to that eastern kingdom is not untrodden by the Huns; already they have marched fifteen days from a certain lake, and have ravaged Media." They also appear before the end of this interval to have pushed westward as far as to the Rhone, and to have come into conflict with the Burgundians. Overt acts of hostility, however, occurred against the Eastern empire when the town of Margus (by the treachery of its bishop), was seized and sacked (441), and against the Western when Sirmium was invested and taken. In 445 Bleda died, and two years afterward Attila, now sole ruler, undertook one of his most important expeditions against the Eastern empire; on this occasion he pushed southward as far as Thermopylæ, Gallipoli, and the walls of Constantinople; peace was cheaply purchased by tripling the yearly tribute (which accordingly now stood at 2,100 pounds of gold, or \$420,000) and by the payment of a heavy indemnity besides. In 448 again occurred various diplomatic negotiations, and especially the embassy of Maximin, of which many curious details have been recorded by Priscus, his companion. Then followed, in 451, that westward movement across the Rhine which was only arrested at last, with terrible slaughter, on the Catalaunian plains (according to common belief, in the neighborhood of the modern Châlons, but more probably at a point some fifty miles to the southeast, near Mery-sur-Seine). The following year (452), that of the Italian campaign, was marked by such events as the sack of Aquileia, the destruction of the cities of Venetia, and finally, on the banks of the Mincio, that historical interview with Pope Leo I. which resulted in the return of Attila to Pannonia, where in 453 he died. Almost immediately afterward, the empire he had amassed rather than consolidated fell to pieces. His too numerous sons began to quarrel about their inheritance, while Ardaric, the king of the Gepidæ, was placing himself at the head of a general revolt of the dependent nations. The inevitable struggle came to a crisis near the river Netad in Pannonia, in a battle in which 30,000 of the Huns and their confederates, including Ellak, Attila's eldest son, were slain. The nation, thus broken, rapidly dispersed; one horde settled under Roman protection in Little Scythia (the Dobrudscha), others in Dacia Ripensis (on the confines of Servia and Bulgaria) or on the southern borders of Pannonia. The main body, however, appeared to have resumed the position on the steppes of the river Ural which they had left less than a century before; soon afterward they reappeared in history as the Bulgari, divided into two sections, the Kuturguri, and the less formidable Uturguri, who for more than seventy years (485-557) were a constant source of annoyance and danger to the Eastern empire, until they themselves fell under the rising power of the Avars. About the year 630 they succeeded in regaining their independence, under the leadership of a chief named Krobat, or more properly Kubrat, a person of great consequence, who made a treaty with the emperor Heraclius. After his death his dominions, according to Theophanes (who wrote about 800 A.D.), were divided among his five sons, of whom the eldest, Batbaïas, remained with his own people near the Mæotis, while the third, Asperuch, crossed the Danube. At a later period the first of these divisions came into close relations with the Khazars on the Volga, and their territory is spoken of as Great Bulgaria.

We have no adequate philological data for conclusively determining the ethnological position of the ancient Huns; and, in the attempt to solve the problem by other means, the student is at all points much hampered by the vagueness and inaccuracy with which

designations, apparently ethnological, are applied by ancient writers. Their subsequent history is very obscure; but it appears that one section of them fled westward and settled in the neighborhood of the Ural river, and the extremely tempting hypothesis of De Guignes is that these were the direct ancestors of the Huns, who three centuries afterward began, under Balamir, to exercise so formidable an influence on the affairs of Europe. If so, then the Huns in all probability belonged to the Turkish branch of the great Turanian race.

According to the totally distinct line of investigation followed by Roseler, however, the Bulgarians, and therefore the Huns whose descendants they were, are to be regarded as of Finnic origin. It has only to be added that by mediæval writers, both Byzantine and Western, the word Hun is used much as the word Scythian was used by the ancients, with the utmost generality. No very close connection can be made out between the Huns and Magyars who first became prominent about the ninth century and who were undoubtedly Finns.

HUNT, JAMES HENRY LEIGH, one of the most delightful of English essayists and miscellaneous writers, and especially remarkable for his connection with the most eminent literati of his time, was born at Southgate, October 19, 1784. He was educated at Christ's Hospital, of which school as it existed in his time he has left a lively account in his autobiography. An impediment in his speech, afterward removed, prevented his being sent to the university. He began to write for the newspapers, published a volume of theatrical criticisms in 1807, and in 1808 quitted the War Office, where he had for some time filled a situation as clerk, to assume the editorship of the *Examiner* newspaper, a speculation of his brother John. In 1816 he made a permanent mark in English literature by the publication of his *Story of Rimini*. Hunt left England for Italy in November, 1821, but storm, sickness, and misadventure retarded his arrival until June, 1822, a rate of progress which Peacock appropriately compares to the navigation of Ulysses.

Hunt's arrival in Italy was almost immediately followed by the tragic death of Shelley. Hunt was now virtually a dependent upon Byron, and in 1823 Byron sailed for Greece, leaving his coadjutor at Genoa to shift for himself. The Italian climate and manners, however, were entirely to Hunt's taste, and he protracted his residence until 1825, producing in the interim his matchless translation of Redi's *Bacco in Toscana*, and the religious work subsequently published under the title of *The Religion of the Heart*. In 1825 an unfortunate litigation with his brother brought him back to England, and in 1827 he committed the greatest mistake of his life by the publication of his *Lord Byron and his Contemporaries*. The book's reception was even more unfavorable than its deserts. British manliness and British cant were for once equally shocked, and the author especially writhed under the withering satire of Moore. For many years ensuing, the history of Hunt's life is that of a painful struggle with poverty and sickness. He worked unremittingly, but one effort failed after another. Two periodical ventures, the *Tatler* and the *London Journal*, were discontinued for want of subscribers, although in the latter Leigh Hunt had able coadjutors, and it contained some of his best writing. His editorship of the *Monthly Repository*, in which he succeeded W. J. Fox, was also unsuccessful. In 1840 his circumstances were improved by the successful representation of his *Legend of Florence*, a play of great merit, although it has not maintained itself upon the stage. *Lover's Amazements*, a comedy, was acted

several years afterward; and other plays are extant in MS. The pretty narrative poem of *The Palfrey* was published in 1842; and about this time he began to write for the *Edinburgh Review*. In 1844 he was further benefited by the generosity of Mrs. Shelley and her son, the late baronet, who, on succeeding to the family estates, settled an annuity of £120 upon him; and in 1847 Lord John Russell procured him a civil list pension of £200. The fruits of the improved comfort and augmented leisure of these latter years were visible in the production of some charming volumes. Foremost among these are the companion books, *Imagination and Fancy* and *Wit and Humor*. His companion volume on the pastoral poetry of Sicily, quaintly entitled *A Jar of Honey from Mount Hybla*, is almost equally delightful. *The Town and Men, Women, and Books* are partly made up from former material. The *Old Court Suburb* is an anecdotic sketch of Kensington, where he long resided before his final removal to Hammersmith. In 1850 he published his autobiography, a naive and accurate piece of self-portraiture, full of affectations, but on that very account free from the affectation of unreality. It is more chary of portraits of contemporaries than might have been expected, but contains very detailed accounts of some of the most interesting periods of the author's life, his education at Christ's Hospital, his imprisonment, and his residence in Italy. In 1855 his narrative poems, original and translated, were collected under the title of *Stories in Verse*, with an interesting preface. He died at Putney, on August 28, 1859.

HUNT, WILLIAM HENRY, water-color painter, was born near Long Acre, London, March 28, 1790. He died of apoplexy, February 10, 1864.

HUNTER, JOHN—as physiologist and surgeon combined, unrivaled in the annals of medicine—born February 13, 1728, at Long Calderwood, in the parish of East Kilbride, Lanarkshire, was the youngest of ten children of John and Agnes Hunter. Hunter is said to have made but little progress at school, being adverse to its restraints and pursuits, and fond of country amusements. When seventeen years old he repaired to Glasgow, where he for a short time assisted his brother-in-law, Mr. Buchanan, a cabinetmaker, who had involved himself in pecuniary difficulties. Being desirous at length of some settled occupation, he obtained from his brother William permission to aid, under Mr. Symonds, in making dissections in his anatomical school, then the most celebrated in London, intending, should he be unsuccessful there, to enter the army. He arrived accordingly in the metropolis in September, 1748, about a fortnight before the commencement of his brother's autumnal course of lectures. After succeeding beyond expectation with the dissection of the muscles of an arm, he was intrusted with a similar part injected, and from the excellence of his second essay Doctor Hunter predicted that he would become a good anatomist. Seemingly John Hunter had hitherto received no instruction in preparation for the special course of life upon which he had entered.

Hard-working, and singularly patient and skillful in dissection, Hunter had by his second winter in London acquired sufficient anatomical knowledge to be intrusted with the charge of his brother's practical class, with the members of which, as also with the resurrection men, he was a universal favorite. In the summer months of 1749-50, at Chelsea Military Hospital, he attended the lectures and operations of Cheselden, on whose retirement in the following year he became a surgeon's pupil at St. Bartholomew's, where Pott was one of the senior surgeons. In the summer of 1752 he visited Scotland. Home and, following him, Ottley state that Hunter be-

gan in 1754 to assist his brother as his partner in lecturing; according, however, to the *European Magazine* for 1782, the office of lecturer was offered to Hunter by his brother in 1758, but declined by him on account of the "insuperable embarrassments and objections" which he felt to speaking in public. In 1754 he became a surgeon's pupil at St. George's Hospital, where he was appointed house-surgeon in 1756.

An attack of inflammation of the lungs in the spring of 1759, apparently caused by overwork, having produced symptoms threatening consumption, by which the promising medical career of his brother James had been cut short, Hunter, with a view to residence abroad for a season, obtained from Mr. Adair in October, 1760, the appointment of staff-surgeon in Hodgson and Kappel's expedition to Belleisle. With this he sailed in 1761. In the following year he served with the English forces on the frontier of Portugal. While with the army he acquired the extensive knowledge of gunshot wounds embodied in his important treatise on that subject, published in 1794, in which, among other matters of moment, he insists on the rejection of the indiscriminate practice of dilating with the knife followed almost universally by surgeons of his time.

On arriving in England early in 1763, Hunter, having retired from the army on half-pay, took a house in Golden Square, and commenced the career of a London surgeon. In connection with his rupture of a tendo Achillis, in 1767, he performed on dogs several experiments which, with the illustrations in his museum of the reunion of such structures after division, laid the foundation of the modern practice of cutting through tendons for the relief of distorted and contracted joints. In the same year he was made a fellow of the Royal Society. Hunter, on December 9, 1768, was elected a surgeon to St. George's Hospital, and, soon after, a member of the Corporation of Surgeons. He now began to take house-pupils. Among these were Edward Jenner, who came to him in 1770, and until the time of Hunter's death corresponded with him on the most intimate and affectionate terms, W. Guy, Kingston, Doctor Physick of Philadelphia, and Everard Home, his brother-in-law. Mr. Lynn and Sir A. Carlisle, though not inmates of his house, were frequent visitors there. His pupils at St. George's included Abernethy, Cline, James Earle, and Astley Cooper. From the high reputation in their profession which these, one and all, attained, some estimate may be formed of the weight and value of Hunter's personal influence and teaching. In 1770 he settled in Jermyn Street, in the house which his brother William had previously occupied; and in July, 1771, he married Anne, the eldest daughter of Mr. Robert Home, surgeon to Burgoyne's regiment of light-horse.

From 1772 till his death Hunter resided during autumn at a house built by him at Earl's Court, Brompton, where most of his biological researches were carried on. There he kept for the purpose of study and experiment the fishes, lizards, blackbirds, hedgehogs, and other animals sent him from time to time by Jenner, tame pheasants and partridges, at least one eagle, toads, silkworms, and many more creatures obtained from every quarter of the globe. Bees he had under observation in his conservatory for upward of twenty years; hornets and wasps were also diligently studied by him. On two occasions his life was in risk from his pets—once in wrestling with a young bull, and again when he fearlessly took back to their dens two leopards which had broken loose among his dogs. Choosing intuitively the only true method of philosophical discovery, Hunter, ever cautious of confounding fact and hypothesis, besought of nature the truth through the medium of manifold experiments and observations. "He had never read

Bacon," says Babington, "but his mode of studying nature was as strictly Baconian as if he had." To Jenner, who had offered a conjectural explanation of a phenomenon, he writes, August 2, 1775: "I think your solution is just; but why think? why not try the experiment? Repeat all the experiments upon a hedgehog as soon as you receive this, and they will give you the solution." Perhaps no man busily engaged in professional practice has ever conducted so many physiological and pathological investigations in the animal world as Hunter; and yet it was with him an axiom "that experiments should not be often repeated which tend merely to establish a principle already known and admitted, but that the next step should be the application of that principle to useful purposes." During fifteen years he kept a flock of geese simply in order to acquaint himself with the development of birds in eggs, with reference to which he remarked: "It would almost appear that this mode of propagation was intended for investigation." In his toxicological and other researches, in which his experience had led him to believe that the effects of noxious drugs are nearly similar in the brute creation and in man, he had already, in 1780, as he states, "poisoned some thousands of animals."

By inserting shot at definite distances in the leg-bone of young pigs, and also by feeding them with madder, by which all fresh osseous deposits are tinged, Hunter obtained evidence that bones increase in size, not by the intercalation of new among old particles, as had been imagined by Duhamel, but by means of additions to their extremities and circumference, excess of calcareous tissue being removed by the absorbents. Some of his most extraordinary experiments were to illustrate the relation of strength of constitution to sex. He exchanged the spurs of a young cock and a young pullet, and found that on the former the transplanted structure grew to a fair size, on the latter but little; whereas a spur from one leg of a cock transferred to its comb, a part well supplied with blood, grew more than twice as fast as that left on the other leg. Another experiment of his, which required many trials for success, was the engrafting of a human incisor on the comb of a cock. The uniting of parts of different animals when brought into contact he attributed to the production of adhesive instead of suppurative inflammation, owing to their possession of "the simple living principle." The effects of habit upon structure were illustrated by Hunter's observation that in a seagull which he had brought to feed on barley the muscular parietes of the gizzard became greatly thickened. A similar phenomenon was noticed by him in the case of other carnivorous birds fed on a vegetable diet.

It was in 1772 that Hunter, in order effectually to gauge the extent of his own knowledge, and also to correctly express his views, which had been repeatedly misstated or ascribed to others, commenced his lectures on the theory and practice of surgery, at first delivered free to his pupils and a few friends, but subsequent to 1774 on the usual terms, four guineas. His class was usually small, and never exceeded thirty. Among its members at various times were Abernethy, Carlisle, Chevalier, Cline, Coleman, Astley Cooper, Home, Lynn, and Macartney. Hunter was deficient in the gifts of a good extempore speaker, being in this respect a remarkable contrast to his brother William; and he read his lectures, seldom raising his eyes from the manuscript.

In January, 1776, Hunter was appointed surgeon-extraordinary to the king. He commenced in the same year his Croonian lectures on muscular motion, continued annually, except in 1777, till 1782; they were never published by him, being in his opinion too incomplete. In 1778 appeared the second part of his *Treatise*

on the *Natural History of the Human Teeth*, the first part of which was published in 1771.

In 1783 Hunter was elected a member of the Royal Society of Medicine and of the Royal Academy of Surgery at Paris, and took part in the formation of "A Society for the Improvement of Medical and Chirurgical Knowledge."

Among the subjects of Hunter's physiological investigations in 1785 was the mode of growth of deer's antlers. As he possessed the privilege of making experiments on the deer in Richmond Park, he in July of that year had a buck there caught and thrown, and tied one of its external carotid arteries. He observed that the antler which obtained its blood supply therefrom, then half-grown, became in consequence cold to the touch. Hunter debated with himself whether it would be shed in due time, or be longer retained than ordinarily. To his surprise he found, on reëxamining the antler a week or two later, when he wound around the ligatured artery was healed, that it had regained its warmth, and was still increasing in size. Had, then, his operation been in some way defective? To determine this question, the buck was killed and sent to Leicester Fields. On examination Hunter ascertained that the external carotid had been duly tied, but that certain small branches of the artery above and below the ligature had enlarged, and by their anastomoses had restored the blood supply of the growing part. Thus it was evident that under "the stimulus of necessity," to use a phrase of the experimenter, the smaller arterial channels are capable of rapid increase in dimensions to perform the offices of the larger. It happened that, in the ensuing December, there lay in one of the wards of St. George's Hospital a patient of Hunter's, admitted for popliteal aneurism. The disease must soon prove fatal unless by some means arrested. Should the surgeon, following the usual and commonly fatal method of treatment, cut down upon the tumor, and, after tying the artery above and below it, evacuate its contents? Or should he adopt the procedure, deemed by Pott generally advisable, of amputating the limb above it? It was Hunter's aim in his practice, even if he could not dispense with the necessity, at least to diminish the severity of operations, which he considered were an acknowledgment of the imperfection of the art of healing, and compared to "the acts of the armed savage, who attempts to get that by force which a civilized man would get by stratagem." Since, he argued, the experiment with the buck had shown that collateral vessels are capable of continuing the circulation when passage through a main trunk is arrested, why should he not, in his aneurism case, leaving the absorbents to deal with the contents of the tumor, tie the artery in the sound parts, where it is tied in amputation, and preserve the limb? Acting upon this idea, he ligatured his patient's femoral artery in the lower part of its course in the thigh, in the fibrous sheath inclosing the space since known as "Hunter's canal." The leg was found, some hours after the operation, to have acquired a temperature even above the normal. At the end of January, 1786, that is, in six weeks' time, the patient was well enough to be able to leave the hospital. Thus it was that Hunter inaugurated an operation which has been the means of preserving to hundreds life with integrity of limb—an operation which, as the Italian Assalini, who saw it first performed, testifies, "excited the greatest wonder and awakened the attention of all the surgeons in Europe."

Early in 1786 Hunter published his *Treatise on the Venereal Disease*, which, like some of his previous writings, was printed in his own house. Although certain views therein expressed with regard to the rela-

tionship of syphilis have been proved erroneous, the work is a valuable compendium of observations of cases and modes of treatment. Toward the end of the year appeared his *Observations on certain parts of the Animal Economy*, which, besides the more important of his contributions to the *Philosophical Transactions*, contains nine papers on various subjects. By the death of Mr. Middleton in 1786, Hunter became deputy surgeon-general to the army; his appointment as surgeon-general and as inspector-general of hospitals followed in 1790, on the death of Mr. Adair. In 1787 he received the Royal Society's Copley medal as a testimony to the importance of his discoveries in natural history, and was also elected a member of the American Philosophical Society. On account of the increase of his practice and his impaired health, he now obtained the services of Home as his assistant at St. George's Hospital. The death of Pott in December, 1788, secured to Hunter the undisputed title of the first surgeon of England. He resigned to Home, in 1792, the delivery of his surgical lectures, in order to devote himself more fully to the completion of his *Treatise on the Blood, Inflammation, and Gunshot Wounds*, which was published by his executors in 1794. In this, his masterpiece, the application of physiology to practice is especially noticeable. Certain experiments described in the first part, pp. 62-64, which demonstrate that arterialization of the blood in respiration takes place by a process of diffusion of "pure air" or "vital air" (*i.e.*, oxygen) through membrane, were made so early as the summer of 1755.

Hunter in 1792 announced to his colleagues at St. George's, who, he considered, neglected the proper instruction of the students under their charge, his intention no longer to divide with them the fees which he received for his hospital pupils. Against this innovation, however, the governors of the hospital decided in March, 1793. Subsequently, by a committee of their appointing, a code of rules respecting pupils was promulgated, one clause of which, probably directed against an occasional practice of Hunter's, stipulated that no person should be admitted as a student of the hospital without certificates that he had been educated for the medical profession. In the autumn two young Scotchmen, ignorant of the new rule, came up to town and applied to Hunter for admission as his pupils at St. George's. Hunter explained to them how he was situated, but promised to advance their request at the next board meeting at the hospital on October 16th. On that day, having finished a difficult piece of dissection, he went down to breakfast in excellent spirits and in his usual health. After making a professional call, he attended the board meeting. There the interruption of his remarks in behalf of his applicants by a flat contradiction from a colleague brought on one of the old spasmodic heart attacks; he ceased speaking, and retired into an adjoining room only in time to fall lifeless into the arms of Doctor Robertson, one of the hospital physicians. After an hour had been spent in vain attempts to restore animation, his body was conveyed to his house in a sedan chair. Thus, in his sixty-fifth year, and in the height of his mental activity, died John Hunter, "whose range of thought nature alone could fill," and to whom, as to but few among all mankind, had been given wisdom to interpret the dark sayings of nature. His remains were interred privately on October 22, 1793, in the vaults of St. Martin's in the Fields. Thence, on March 28, 1859, through the instrumentality of Mr. Frank Buckland, they were removed to Abbot Islip's chapel in Westminster Abbey, to be finally deposited in the grave in the north aisle of the nave, close to the resting-place of Ben Jonson.

HUNTER, WILLIAM, a celebrated physiologist and physician, and the first great teacher of anatomy in England, was born May 23, 1718, at East Kilbride, Lanark. He had originally been intended for the church, but, scruples concerning subscription arising in his mind, he followed the advice of his friend, William Cullen, and resolved to devote himself to physic. In 1746 Hunter undertook, in place of Mr. Samuel Sharpe, the delivery, for a society of naval practitioners, of a series of lectures on operative surgery, and so satisfactorily did he acquit himself of his task that he was requested to include anatomy in his course. It was not long before he attained considerable fame as a lecturer; for not only was his oratorical ability great, but he differed from his contemporaries in the fullness and thoroughness of his teaching, and in the care which he took to provide for his hearers the best possible practical illustrations of his discourses. In 1747 Hunter became a member of the Corporation of Surgeons. In the course of a tour through Holland to Paris, with his pupil, J. Douglas, in 1728, he visited Albinus at Leyden, and inspected with admiration his injected preparations. By degrees Hunter renounced surgical for obstetric practice, in which he excelled. He was appointed a surgeon-accoucheur at the Middlesex Hospital in 1748, and at the British Lying-in Hospital in the year following. The degree of M.D. was conferred upon him by the university of Glasgow, October 24, 1750. About the same time he left his old abode at Mrs. Douglas', and settled as a physician in Jernyn Street. He became a licentiate of the College of Physicians, September 30, 1756. In 1762 he was consulted by Queen Charlotte, and in 1764 was made physician-extraordinary to her Majesty.

During the closing ten years of his life his health failed greatly. His last lecture, at the conclusion of which he fainted, was given, contrary to the remonstrances of friends, only a few days before his death, which took place March 30, 1783. He was buried in the rector's vault at St. James', Piccadilly.

HUNTING. The circumstances which render necessary the habitual pursuit of wild animals, either as a means of subsistence or for self-defense, generally accompany a phase of human progress distinctly inferior to the pastoral and agricultural stages; resorted to as a recreation, on the other hand, the practice of the chase in most cases indicates a considerable degree of civilization, and sometimes ultimately becomes the almost distinctive employment of the classes which are possessed of most leisure and wealth. It is only in some of its latter aspects, viz., as a "sport," pursued on fixed rules and principles, that hunting requires notice here.

The information we possess as to the field sports of the ancients is in many directions extremely fragmentary. With regard to the ancient Egyptians, however, we learn that the huntsmen constituted an entire subdivision of the great second caste; they either followed the chase on their own account, or acted as the attendants of the chiefs in their hunting excursions, taking charge of the dogs, and securing and bringing home the game. The game was sought in the open deserts which border on both sides the valley of the Nile; but (by the wealthy) sometimes in inclosed spaces into which the animals had been driven, or in preserves. Besides the noose and the net, the arrow, the dart, and the hunting pole or *venabulum* were frequently employed. The animals chiefly hunted were the gazelle, ibex, oryx, stag, wild ox, wild sheep, hare, and porcupine; also the ostrich for its plumes, and the fox, jackal, wolf, hyena, and leopard for their skins, or as enemies of the farmyard. The lion was occasionally trained as a hunting animal instead of the dog. The sportsman appears, occasion-

ally at least, in the later periods, to have gone to cover in his chariot or on horseback; according to Wilkinson, when the dogs threw off in a level plain of great extent, it was even usual for him "to remain in his chariot, and, urging his horses to their full speed, endeavor to turn or intercept them as they doubled, discharging a well-directed arrow whenever they came within its range." The partiality for the chase which the ancient Egyptians manifested was shared by the Assyrians and Babylonians, as is shown by the frequency with which hunting scenes are found depicted on the walls of their temples and palaces, and also by the alleged fact that even their dresses and furniture were ornamented with similar subjects. The game pursued included the lion, the wild ass, the gazelle, and the hare, and the implements chiefly employed seem to have been the javelin and the bow. There are indications that hawking was also known. The Assyrian kings also maintained magnificent parks, or "paradises," in which game of every kind was inclosed; and perhaps it was from them that the Persian sovereigns borrowed the practice mentioned both by Xenophon in the *Cyropædia*, and by Curtius. According to Herodotus, Cyrus devoted the revenue of four great towns to meet the expenses of his hunting establishments. The circumstances under which the death of the son of Croesus is by the same writer related to have occurred incidentally show in what high estimation the recreation of hunting was held in Lydia.

Hunting scenes are frequently represented in ancient works of art, especially the boar-hunt, and also that of the hare. In Roman literature allusions to the pleasures of the chase (wild ass, boar, hare, fallow deer, being specially mentioned as favorite game) are not wanting; it seems to have been viewed, however, with less favor as an occupation for gentlemen, and to have been chiefly left to inferiors and professionals. The immense *vivaria* or *theriotropheia*, in which various wild animals, such as boars, stags, and roe-deer, were kept in a state of semi-domestication, were developments which arose at a comparatively late period; as also were the *venationes* in the circus, although these are mentioned as having been known as early as 186 B.C. The bald and meager poem of Gratius Faliscus on hunting is modeled upon Xenophon's prose work; a still extant fragment (315 lines) of a similar poem with the same title, of much later date, by Nemesianus, seems to have at one time formed the introduction to an extended work corresponding to that of Oppian. That the Romans had borrowed some things in the art of hunting from the Gauls may be inferred from the name *canis gallicus* for a greyhound, which is to be met with both in Ovid and Martial; also in the word (*canis*) of Celtic origin. According to Strabo (p. 200) the Britons also bred dogs well adapted for hunting purposes. The addiction of the Franks in later centuries to the chase is evidenced by the frequency with which not only the laity but also the clergy were warned by provincial councils against expending so much of their time and money on hounds, hawks, and falcons; and we have similar proof with regard to the habits of other Teutonic nations subsequent to the introduction of Christianity. Originally among the northern nations sport was open to everyone except to slaves, who were not permitted to bear arms; the growth of the idea of game-preserving was a gradual one, and kept pace with the development of feudalism. The origin of the sport in Britain does not admit of being historically traced. Doubtless the early inhabitants shared to a large extent in the habits of the other Celtic people; the fact that at least they kept good hunting dogs is vouched for, as we have seen by Strabo. When the period of Alfred the Great is reached, we have it on the authority of Asserius, his biographer, that before he

was twelve years of age he "was a most expert and active hunter, and excelled in all branches of that noble art, to which he applied with incessant labor and amazing success." Of his grandson Athelstan it is related by William of Malmesbury that after the victory of Brunanburgh he imposed upon the vanquished king of Wales a yearly tribute, which included a certain number of "hawks and sharp-scented dogs fit for hunting wild beasts." According to the same authority, one of the greatest delights of Edward the Confessor was "to follow a pack of swift hounds in pursuit of game, and to cheer them with his voice." It was under the Anglo-Saxon kings that the distinction between the higher and lower chase first came to be made—the former being expressly for the king or those on whom he bestowed the pleasure of sharing in it, while only the latter was allowed to the proprietors of the land. To the reign of Cnut belong the "Constitutiones de Foresta," according to which four thanes were appointed in every province for the administration of justice in all matters connected with the forests; under them were four inferior thanes to whom was committed immediate care of the vert and venison. The severity of the forest laws which prevailed during the Norman period is sufficient evidence of the sporting ardor of William and his successors. The Conqueror himself, we are told by his contemporaries, "loved the high game as if he were their father;" and the penalty for the unauthorized slaughter of a hart or hind was loss of both eyes.

In the great wilds of America game is so abundant that the elaborate preparations of the sportsman of the old world would be altogether superfluous, and the technology of the chase would be unintelligible jargon to the Western Nimrod. The principal requisites of the huntsman in this country, while of course varying with the class of game intended to fall before his onslaught, may in general terms be said to comprise a knowledge of the habits and habitat of the game sought, a steady nerve, and a proper equipment in the matter of arms and ammunition. In the great West in particular, the close intermingling of noble and ignoble game renders it imperative that the hunter, even while in quest of small game, shall be prepared for the emergency of unexpectedly facing quarry of a far different and more dangerous character than that which he starts out to bag. He may start out in quest of jackrabbits or "prairie chickens," but may walk unexpectedly into the comfortable embrace of a bear; in the far West the bear may be of the ferocious type *ursus horribilis*, or it may be may give place to its equally dangerous neighbor the "mountain lion." Thus it behooves the American sportsman to be fully acquainted with the fauna of the region in which he exploits, and to have at his ready command a weapon light enough for small game and yet powerful enough to kill the largest and most tenacious of life.

The various species of game offered by the country comprise an infinity of furred, feathered and hairy tribes. It may be said that no region of the vast continent is destitute of representatives of the three great classes mentioned. These call into requisition the shotgun of various bores and powers, and the rifle of varying weight, caliber, power and capacity for slow or quick firing. Some game requires the use of trained dogs to force it from cover, while with others it is only necessary for the hunter to tramp over the territory occupied by it and in the vernacular of the people "kick it up." In the Southern States quail are shot over dogs, or "flushed" as described. Deer may be raised from cover by trailing with dogs, or the hunter may elect to go on a "still hunt"—either mode being generally equally successful. Foxes are uniformly run with hounds, but never intentionally allowed to escape—their

numbers being so great as to render thinning out desirable. Hares may be chased with dogs, which drive them toward the hunter, to be shot by him, or they may be "still hunted" mornings and evenings, when they come out to feed. Bears are sometimes trailed by hounds, but some species and individuals are too pugnacious to retreat before canine pursuers, in which case the dog is only useful to apprise the hunter of the whereabouts of the game. Black bears will usually retreat before the advance of dogs, but the grizzly is generally too dignified to leave any particular locality on account of such petty annoyance. In the Western States the dogs used by huntsmen are generally confined to those which trail feathered game. Elk, deer, moose, buffalo, mountain sheep, bears, and such larger game are uniformly "still-hunted," the hunter being usually armed with a repeating rifle of the heavier class and high power. Hunting in these regions is not only exciting sport, but becomes dangerous work in many cases, and the tyro should never set out on an expedition unattended. Even old, experienced frontiersmen often lose their lives, or limbs, in encounters with the terrible animals who make their lairs among the mountain fastnesses of the Rockies.

As to the armament of the American sportsman, a few general hints may be timely. In the older communities it is generally sufficient that the hunter carry a light fowling-piece, with such minor accessories as render his pursuit of game more convenient; but even in these localities if there be any cover afforded for larger animals it would be better and more prudent for him to carry with him a few extra cartridges of heavy shot with larger charges of powder. This precaution will not only render him able to bag larger game than that which he seeks, but will often stand him in good stead in the defense of his life against wild animals of a dangerous nature, unexpectedly encountered—a not infrequent circumstance in the heavily wooded portions of the Eastern and Southern States, where occasional specimens of bear, panther, wildcat, etc., are seen. In new, not long settled localities, the rifle (repeating) is a *sine qua non*. As before stated, it should be of sufficient caliber and power to be effective against the most dangerous animals, and yet be of such weight as not to be an excessive burden at the end of a long day's tramp. The charge both of powder and lead can be varied to suit the game sought, but it is the part of wisdom to be always ready for any emergency, and to this end a weapon should be selected in which the charge can be quickly changed as occasion may require. This item having received attention, the hunter should be careful to always have at hand a few cartridges of extra size. To this end, the most serviceable weapon for sportsmen is probably the Winchester—the "Express" for a country where dangerous game may be encountered. In this rifle cartridges of different degrees of strength and bullets of different weight can be used ("Express," solid or explosive), and while it can be used as a magazine rifle, it can also be loaded at the breech as an ordinary single shot breech-loader. This gives it great ease of change of charge in case any game requiring such change shall suddenly appear. There are other rifles in use, which claim to be equally good, but the majority of choice in the United States seems to be with the one mentioned.

In hunting in America the horse is rarely used, except in case of fox-hunting, the distances covered by game not being usually great, and the country being of such a nature as to preclude the use of the horse in following.

We also find that the elephant, hyena, hunting leopard, and a small species of panther known as the ounce are not only objects of chase, but are themselves trained to assist in the capture of other animals. The elephant

has been found of great service in lion and tiger hunting, his size affording comparative safety to the hunters seated on his back. The hyena, which resembles a dog in many particulars, is said to be as tractable, when properly trained, and to be of much use in the pursuit of game. The hunting leopard or cheetah and the ounce are used in hunting a species of antelope. They have hoods put over their heads, and are taken in a small wagon into the field; when the deer is seen the hood is taken off and the animal starts in pursuit, followed by the hunter; when the game is secured the hood is again put on. In India field sports are largely indulged in, owing partly to natural facilities, and partly to the taste for hunting characteristic of the English residents there. Tigers are sometimes caught in traps, and sometimes shot in the jungle from the back of an elephant; they seek to conceal themselves, and very rarely commence hostilities against mankind, but when severely wounded and brought to bay they fight courageously. Hunting the wild hog, or "pig sticking," as it is often termed, is a favorite sport in India; the ground is walked over by beaters, and when a hog is roused the two mounted huntsmen nearest to him start in pursuit, and endeavor to spear him. The riding requires judgment and very good nerves; hollows, ravines, and cracks in the ground caused by the sun are numerous, and, as they are hidden by the tall grass, the horse cannot avoid them; it is said that no horse can run down a hog in less than a mile, even over the best ground, while over the rough country the distance traveled amounts to three or four. The rider's aim is to blow the hog sufficiently before getting within spearing distance—for the charge of an untired hog is a dangerous affair; but when near a thick cover the sportsman must try to spear him at all hazards, or make up his mind to lose him. The proper management of the spear requires considerable practice. Besides the above mentioned animals, the fox, jackal, wolf, hyena, buffalo, and four-horned antelope are also objects of the chase.

Australia was formerly the scene of a great deal of kangaroo hunting, but that animal is now comparatively scarce.

In Africa there is plenty of big-game hunting, the list including the elephant, lion, giraffe, hippopotamus, antelopes of various kinds, leopard, hyena, buffalo, jackal, and ostrich. Of these the larger and more dangerous animals are killed as opportunity offers, but the jackal is hunted by English settlers like a fox. Ostrich hunting is somewhat peculiar; the bird is pursued by men on horseback, and, though over the ground it is swifter than a horse, it generally runs in a large circle, so that the riders, by describing a smaller circle and relieving one another, are enabled to keep tolerably near to it, and so to ride it down.

In Russia, bears, wolves, and wild boars are hunted. Wolves are found in Germany, where they are not only hunted by properly trained wolf hounds, but are killed by any available means.

HUNTINGDON, or **HUNTS**, an inland county of England, bounded on the north and west by Northampton, south by Bedford, and east by Cambridge. Its extreme breadth is at the middle, from which it narrows gradually and irregularly toward its north and south ends. Its extreme length from north to south is about thirty miles, and its extreme breadth from east to west about twenty-three miles. The area extends to 229,575 imperial acres, or 358 square miles. Among English counties it is the smallest, with the exception of Middlesex and Rutland; and Rutland is the only English county it surpasses in population. Population, 59,491.

HUNTINGDON, a municipal and parliamentary borough of England, capital of the above county, is situated on

the left bank of the Ouse, and on three railway lines, fifty-eight miles north of London, fifteen miles north-west of Cambridge, and nineteen miles south of Peterborough. Oliver Cromwell was born here in 1599, and here the poet Cowper lived from 1765 to 1767. Huntingdon has a population of 4,228.

HUNTINGDON, capital of the Pennsylvania county of the same name, is situated on the Juniata river, thirty-four miles east of Altoona and sixty miles from Harrisburg (ninety-eight by railroad). The town is picturesquely located in the mountains and is a place of considerable trade. It has a national and other banks, tanneries, flouring and planing mills, a car factory and a shoe factory, and issues several newspapers. Population (1889), 6,062.

HUNTINGTON, a post-town, capital of the county of the same name in Indiana, is situated on the Little river, twenty-four miles southwest of Fort Wayne and forty-eight miles east of Logansport. It has extensive water-power, which is utilized to run woolen mills and manufactories of staves and spokes. There are ten churches, a national and one other bank and two newspapers offices. Population (1890), 7,300.

HUNTINGTON, an enterprising and rapidly-growing city in Cabell county, W. Va., is situated on the Ohio river, below the mouth of the Guyandotte river and twenty miles above Ironton, Ohio. Of late years it has developed important manufacturing interests, including foundries, planing mills, manufactories of car wheels and other railroad supplies. It is the seat of Marshall College and of the State Normal School, and has good banking, telegraph and railroad facilities. Huntington has three newspapers, twelve churches and a population by the U. S. census of 1890 of 10,108, having added 7,000 to its numbers within the decade.

HUNTSVILLE, the county seat of Madison county, Ala., is situated in the valley of the Tennessee river, 100 miles south of Nashville, and in the heart of the Cumberland mountains. It is a flourishing town with a population (1890) of 4,635. Huntsville has a national and other banks, cotton factories, an ice-factory, cotton-seed mills and other industries, and has well-shaded streets, gas, water-works and a public park. The first State convention of Alabama was held here, and the first meeting of the legislature.

HUPFELD, **HERMANN**, an eminent Orientalist and Biblical commentator and critic, was born March 31, 1796, at Marburg. He died at Halle, April 24, 1866.

HURD, **RICHARD**, bishop of Winchester, was born at Congreve, in the parish of Penkridge, Staffordshire, where his father was a farmer, on January 13, 1720. He died May 28, 1808.

HURDWAR. See **HARDWAR**.

HURON, **LAKE**. See **ST. LAWRENCE**.

HURRUR. See **HARAR**.

HUSBAND AND WIFE. The history of Roman law exhibits a transition from an extreme theory to its opposite. The position of the wife in the earliest Roman household was regulated by the law of *Manus*. She fell under the "hand" of her husband,—became one of his family, along with his sons and daughters, natural or adopted, and his slaves. The dominion which, so far as the children was concerned, was known as the *patria potestas*, was, with reference to the wife, called the *manus*. The subject members of the family, whether wife or children, had, broadly speaking, no rights of their own, and were merged in the *potestas* of the husband and father. If this institution implied the complete subjection of the wife to the husband, it also implied a much closer bond of union between them than we find in the later Roman law. The wife was at least a member of the family, and on her hus-

band's death she succeeded, like the children, to freedom and a share of the inheritance. *Manus*, however, was not essential to a legal marriage; its restraints were irksome and unpopular, and in course of time it absolutely ceased to exist, leaving no equivalent protection of the stability of family life. The later Roman marriage left the spouses comparatively independent of each other. The bond was easily dissolved, and while it lasted was loose and easy. The distance between the two modes of marriage may be estimated by the fact that, while under the former the wife was one of the husband's immediate heirs, under the latter she was called to the inheritance only after his kith and kin had been exhausted, and only in preference to the treasury. It seems doubtful how far she had, during the continuance of marriage, a legal right to enforce aliment from her husband, although if he neglected her she had the unsatisfactory remedy of an easy divorce. The law in fact preferred to leave the parties to arrange their mutual rights and obligations by private contracts. Hence the importance of the Law of Settlements (*Dotes*). The *Dos* and the *Donatio ante nuptias* were settlements by or on behalf of the husband or wife, during the continuance of the marriage, and the law seems to have looked with some jealousy on gifts made by one to the other in any less formal way, as possibly tainted with undue influence. During the marriage the husband had the administration of the property, and its destination afterward might depend on the nature of the settlement and the conduct of the parties.

The *manus* of the Roman law appears to be only one instance of an institution common to all primitive societies, and suitable only to society in a primitive state. On the continent of Europe after many centuries, during which local usages were brought under the influence of principles derived from the Roman law, a theory of marriage became established, the leading feature of which is the *community of goods* between husband and wife. Describing the principle as it prevails in France, Story says: "This community or nuptial partnership (in the absence of any special contract) generally extends to all the movable property of the husband and wife, and to the fruits, income, and revenue thereof. * * *

* * * It extends also to all immovable property of the husband and wife acquired during the marriage, but not to such immovable property as either possessed at the time of the marriage, or which came to them afterward by title of succession or by gift. The property thus acquired by this nuptial partnership is liable to the debts of the parties existing at the time of the marriage; to the debts contracted by the husband during the community, or by the wife during the community with the consent of the husband; and to debts contracted for the maintenance of the family. * * * The husband alone is entitled to administer the property of the community, and he may alienate, sell, or mortgage it without the concurrence of the wife." But he cannot dispose by will of more than his share of the common property, nor can he part with it gratuitously *inter vivos*. The community is dissolved by death (natural or civil), divorce, separation of body, or separation of property. On separation of body or of property the wife is entitled to the full control of her movable property, but cannot alienate her immovable property without her husband's consent, or legal authority. On the death of either party the property is divided in equal moieties between the survivor and the heirs of the deceased.

The English common law has as usual followed its own course in dealing with this subject, and in no department are its rules more entirely insular and independent. The text-writers all assume two fundamental principles, which between them establish a system of

rights totally unlike that we have just described. Husband and wife are said to be one person in the eye of the law. Hence a man cannot grant or give anything to his wife, because she is himself, and if there are any compacts between them before marriage they are dissolved by the union of persons. Hence, too, the old rule of law, now greatly modified, that husband and wife could not be allowed to give evidence against each other in any trial, civil or criminal. The unity, however, is one-sided only; it is the wife who is merged in the husband, not the husband in the wife. And when the theory does not apply, the disabilities of "coverture" suspend the active exercise of the wife's legal faculties. The old technical phraseology describes husband and wife as *baron* and *femme*; the rights of the husband are baronial rights. From one point of view the wife is merged in the husband, from another she is one of his vassals. A curious example is the immunity of the wife in certain cases from punishment for crime committed in the presence and on the presumed coercion of the husband. "So great a favorite," says Blackstone, "is the female sex of the laws of England."

In the United States the relation of husband and wife is a subject of State law, and the positions taken in the various States are so numerous and varied as to preclude mention in detail in this article. It may, however, be stated that the different States have founded their statutes on the subject on the English law, which is more or less modified to meet various exigencies arising in the experience of the people.

HUSCH, HUSHI, or HUSI, chief town of the Roumanian province of Falcu, Moldavia, is situated on the right bank of the Pruth, about forty miles southeast of Jassy. Population, 18,500.

HUSHIARPUR, a British district in the lieutenant-governorship of the Punjab, India. It forms the central district of the Jalandhar division, and is bounded northeast by the district of Kangra and the native state of Nalagarh, north and northwest by the river Bias, southwest by Jalandhar, and south by the river Satlaj (Sutlej) and Ambála (Umballa) district.

HUSHIARPUR, municipal town and administrative headquarters of the above district, is situated on the bank of a broad sandy torrent. The population in 1888 numbered 13,022, comprising 6,350 Hindus, 6,002 Mohammedans, 119 Sikhs, 62 Christians, and 489 "others."

HUSS, JOHN, the Bohemian reformer and martyr, was born at Hussinecz, a market-village at the foot of the Böhmerwald, and not far from the Bavarian frontier, most probably in 1369, and, according to some accounts, on July 6th. His parents appear to have been well-to-do Czechs of the peasant class. Of his early life nothing is recorded except that, notwithstanding the early loss of his father, he obtained a good elementary education, first at Hussinecz, and afterward at the neighboring town of Prachaticz. At, or only a very little beyond, the usual age he entered the recently (1348) founded university of Prague, where he became bachelor of arts in 1393, bachelor of theology in 1394, and master of arts in 1396. In 1398 he was chosen by the Bohemian "nation" of the university to an examinership for the bachelor's degree; in the same year he began to lecture also, and there is reason to believe that the philosophical writings of Wickliffe, with which he had been for some years acquainted, were his textbooks. In October, 1401, he was made dean of the philosophical faculty, and for the half-yearly period from October, 1402, to April, 1403, he held the office of rector of the university. In 1402 also he was made rector or curate (capellarius) of the Bethlehem Chapel, which had in 1391 been erected and endowed by some zealous citizens of Prague for the purpose of providing good

popular preaching in the Bohemian tongue. This appointment, which, so far as the aims of the pious founders were concerned, proved a singularly successful one, had a deep influence on the already vigorous religious life of Huss himself; and one of the effects of the earnest and independent study of Scripture into which it soon led him was a profound conviction of the great value not only of the philosophical but also of the theological writings of Wickliffe.

This newly-formed sympathy with the English reformer did not, however, in the first instance at least, involve Huss in any conscious opposition to the established doctrines of Catholicism, or in any direct conflict with the authorities of the church; and for several years he continued to act in full accord with his archbishop (Sbynjek, or Sbynko, of Hasenburg). Thus in 1405 he, along with other two masters, was commissioned to examine into certain reputed miracles at Wilsnack, near Wittenberg, which had caused that church to be made a resort of pilgrims from all parts of Europe. The result of their report was that all pilgrimage thither from the province of Bohemia was prohibited by the archbishop on pain of excommunication, while Huss, with the full sanction of his superior, gave to the world his first published writing, entitled *De Omni Sanguine Christi Glorificato*, in which he declaimed in no measured terms against forged miracles and ecclesiastical greed, urging Christians at the same time to desist from looking for sensible signs of Christ's presence, but rather to seek Him in His enduring word. More than once also Huss, along with his friend Stanislaus of Znaim, was appointed to be synod-preacher, and in this capacity he delivered at the provincial councils of Bohemia many faithful admonitions. As early as May 28, 1403, it is true, there had been held a university disputation about the new doctrines of Wickliffe, which had resulted in the condemnation of certain propositions presumed to be his; five years later (May 20, 1408) this decision had been refined into a declaration that these, forty-five in number, were not to be taught in any heretical, erroneous, or offensive sense. But it was only slowly that the growing sympathy of Huss with Wickliffe unfavorably affected his relations with his colleagues in the priesthood. In 1408, however, the clergy of the city and archiepiscopal diocese of Prague laid before the archbishop a formal complaint against Huss, arising out of strong expressions with regard to clerical abuses of which he had made use in his public discourses; and the result was that, having first been deprived of his appointment as synodal preacher, he was, after a vain attempt to defend himself in writing, publicly forbidden the exercise of any priestly function throughout the diocese. Simultaneously with these proceedings in Bohemia, international negotiations had been going on which had for their object the removal of the long-continued papal schism, and it had in the interval become apparent that a satisfactory solution of the difficulties involved could only be secured if, as seemed not impossible, the supporters of the rival popes, Benedict XIII. and Gregory XII., could be induced, in view of the approaching council of Pisa, to pledge themselves to a strict neutrality. With this end King Wenceslaus of Bohemia had requested the cooperation of the archbishop and his clergy, and also the support of the university, in both instances unsuccessfully, although in the case of the latter the Bohemian "nation," with Huss at its head, had only been overborne by the votes of the Bavarians, Saxons, and Poles. There followed an expression of nationalist and particularistic as opposed to ultramontane and also to German feeling, which undoubtedly was of supreme importance for the whole of the subsequent career of Huss. In

compliance with this feeling a royal edict (January 18, 1409) was issued, by which, in alleged conformity with Paris usage, and with the original charter of the university, the Bohemian "nation" received three votes while only one was allotted to the other three "nations" combined; whereupon all the foreigners, to the number of several thousands, almost immediately withdrew from Prague, an occurrence which led to the formation shortly afterward of the university of Leipsic.

It was a dangerous triumph for Huss; for his popularity at court and in the general community had been secured only at the price of clerical antipathy everywhere and of much German ill-will. Among the first results of the changed order of things were on the one hand the election of Huss (October, 1409) to be again rector of the university, but on the other hand the appointment by the archbishop of an inquisitor to inquire into charges of heretical teaching and inflammatory preaching which had been brought against him. He had spoken disrespectfully of the church, it was said, had even hinted that Antichrist might be found to be in Rome, had fomented in his preaching the quarrel between Bohemians and Germans, and had, notwithstanding all that had passed, continued to speak of Wickliffe as both a pious man and an orthodox teacher. The direct result of this investigation is not known, but it is impossible to disconnect from it the promulgation by Pope Alexander V., on December 20, 1409, of a bull which ordered the abjuration of all Wickliffite heresies and the surrender of all his books, while at the same time—a measure specially leveled at the pulpit of Bethlehem Chapel—all preaching was prohibited except in localities which had been by long usage set apart for that use. This decree, as soon as it was published in Prague (March 9, 1410), led to much popular agitation, and provoked an appeal by Huss to the pope's better informed judgment; the archbishop, however, resolutely insisted on carrying out his instructions, and in the following July caused to be publicly burned, in the courtyard of his own palace, upward of 200 volumes of the writings of Wickliffe, while he pronounced solemn sentence of excommunication against Huss and certain of his friends, who had in the meantime again protested and appealed to the new pope, (John XXIII.) Again the populace rose on behalf of their hero, who, in his turn, strong in the conscientious conviction that "in the things which pertain to salvation God is to be obeyed rather than man," continued uninterruptedly to preach in the Bethlehem Chapel, and in the university began publicly to defend the so-called heretical treatises of Wickliffe, while from king and queen, nobles and burghers, a petition was sent to Rome praying that the condemnation and prohibition in the bull of Alexander V. might be quashed. Negotiations were carried on for some months, but in vain; in March, 1411, the ban was anew pronounced upon Huss as a disobedient son of the church, while the magistrates and councilors of Prague who had favored him were threatened with a similar penalty in case of their giving him a contumacious support. Ultimately the whole city, which continued to harbor him, was laid under interdict; yet he went on preaching, and masses were celebrated as usual, so that at the date of Archbishop Sbynko's death in September, 1411, it seemed as if the utmost efforts of ecclesiastical authority had resulted in absolute failure.

The struggle, however, entered on a new phase with the appearance at Prague in May, 1412, of the papal emissary charged with the proclamation of the papal bulls by which a religious war was decreed against the excommunicated King Ladislaus of Naples, and indulgence was promised to all who should take part in it, on terms similar to those which had been enjoyed by the

earlier crusaders to the Holy Land. By his bold and thorough-going opposition to this mode of procedure against Ladislaus; and still more by his doctrine that indulgence could never be sold without simony, and could not be lawfully granted by the church except on condition of genuine contrition and repentance, Huss at last isolated himself, not only from the archiepiscopal party under Albik of Unitschow, but also from the theological faculty of the university, and especially from such men as Stanislaus of Znaim and Stephen Paletz, who until then had been his chief supporters. A popular demonstration, in which the papal bulls had been paraded through the streets with circumstances of peculiar ignominy and finally burnt, led to intervention by Wenceslaus on behalf of public order; three young men, for having openly asserted the unlawfulness of the papal indulgence after silence had been enjoined, were sentenced to death (June, 1412); the excommunication against Huss was renewed, and the interdict again laid on all places which should give him shelter—a measure which now began to be more strictly regarded by the clergy, so that in the following December he had no alternative but to yield to the express wish of the king by temporarily withdrawing from Prague. A provincial synod, held at the instance of Wenceslaus in February, 1413, broke up without having reached any practical result; and the labors of a commission appointed shortly afterward were equally unsuccessful in the attempt to bring about a reconciliation between Huss and his adversaries. The so-called heretic meantime spent his time partly at Kozihradek, some forty-five miles south of Prague, and partly at Krakowitz in the immediate neighborhood of the capital, sometimes varying the monotony of his life with an occasional course of open-air preaching, but finding his chief employment in maintaining with his numerous friends that copious correspondence of which some precious fragments still are extant, and in the composition of the largest and most exhaustive of all his printed works, *De Ecclesia*, which subsequently furnished most of the material for the capital charges brought against him.

During the year 1413 the arrangements for the meeting of a general council at Constance were agreed upon between Sigismund and Pope John XXIII. The objects originally contemplated had been the restoration of the unity of the church and its reform in head and members; but so great had become the prominence of Bohemian affairs that to these also a first place in the programme of the approaching œcumenical assembly required to be assigned, and for their satisfactory settlement the presence of Huss was obviously necessary. His attendance was accordingly requested, and the invitation was willingly accepted as giving him a long-wished-for opportunity both of publicly vindicating himself from charges which he felt to be grievous and of loyally making confession for Christ. He set out from Bohemia on October 14, 1414, not, however, until he had carefully ordered all his private affairs, with a presentiment, which he did not conceal, that in all probability he was going to his death. The journey, which appears to have been undertaken with the usual passport, and under the protection of several powerful Bohemian friends (John of Chlum, Wenceslaus of Duba, Henry of Chlum) who accompanied him, was a very prosperous one; and at almost all the halting places he was received with a consideration and enthusiastic sympathy which he had hardly expected to meet with anywhere in Germany. On November 3d he arrived at Constance, and took up quarters in the house which is still pointed out (Paulsgasse, 328); shortly afterward there was put into his hands the famous imperial "safe conduct," the promise of which had been one of his inducements to

quit the comparative security he had enjoyed in Bohemia. Of this safe conduct, the formal words of which have often been quoted, it would be absurd to say that it was intended to guarantee its holder against the infliction of due punishment should he be convicted by existing laws of any crime; but there can be no doubt that both the letter and the spirit of it were scandalously violated, when, on November 28th, Huss was arbitrarily seized and thrown into prison before any accusation whatever had been formulated. Sigismund himself never sought to defend this act, which was not done with his consent or authority; the only excuse he ever alleged for having tolerated it was that otherwise in all likelihood the council would have been broken up. On December 4th the pope appointed a commission of three bishops to investigate the case against the heretic, and to procure witnesses; to the demand of Huss that he might be permitted to employ an agent in his defense a favorable answer was at first given, but afterward even this concession to the forms of justice was denied. While the commission was engaged in the prosecution of its inquiries, the flight of Pope John XXIII. took place on March 20th, an event which furnished a pretext for the removal of Huss from the Dominican convent to a more secure and more severe place of confinement under the charge of the bishop of Constance, at Gottlieben on the Rhine. On May 4th the temper of the council on the doctrinal questions in dispute was for the first time fully revealed in its unanimous condemnation of Wickliffe, especially of the so-called "forty-five articles" as erroneous, heretical, revolutionary. It was not, however, until June 5th that the case of Huss himself came up for hearing; the meeting, which was an exceptionally full one, took place in the refectory of the Franciscan cloister. Autograph copies of his work *De Ecclesia*, and of the controversial tracts which he had written against Paletz and Stanislaus of Znaim, having been laid before him and duly acknowledged, the extracted propositions on which the prosecution based their charge of heresy were read; but as soon as the accused began to analyze them and to enter upon his defense, he was assailed by violent outcries, amid which it was impossible for him to be heard, so that he was compelled to bring his speech to an abrupt close, which he did with the calm remark; "In such a council as this I had expected more propriety, piety, and order." It was found necessary to adjourn the sitting until June 7th, on which occasion the outward decencies were better observed, partly no doubt from the circumstance that the emperor was present in person. The propositions which had been extracted from the *De Ecclesia* were again brought up, and the relations between Wickliffe and Huss were discussed, the object of the prosecution being to fasten upon the latter the charge of having entirely adopted the doctrinal system of the former, including especially a denial of the doctrine of transubstantiation. The accused defended himself by repudiating the charge of having abandoned the Catholic doctrine, while at the same time he gave expression to his hearty admiration and respect for the memory of Wickliffe. Being next asked to make an unqualified submission to the council, he expressed himself as unable to do so, while at the same time stating his willingness in all humility to amend his teaching wherever it had been shown to be false. With this the proceedings of the day were brought to a close. On June 8th the propositions extracted from the *De Ecclesia* were once more taken up with some fullness of detail; some of these he repudiated as incorrectly given, others he defended; but when asked to make a general recantation he steadfastly declined on the ground that to do so would be a dishonest admission of previous

guilt. Among the propositions he could heartily abjure was that relating to transubstantiation; among those he felt constrained unflinchingly to maintain was one which had given great offense, to the effect that Christ, not Peter, is the head of the church to whom ultimate appeal must be made. The council, however, showed itself inaccessible to all his arguments and explanations, and its final resolution, as announced by D'Ailly, was threefold:—first, that Huss should humbly declare that he had erred in all the articles cited against him; secondly, that he should promise on oath neither to hold nor teach them in the future; thirdly, that he should publicly recant them. On his declining to make this submission he was removed from the bar, and it was obvious that the end could not be far off. The emperor himself gave it as his opinion that it had been clearly proved by many witnesses that the accused had taught many pernicious heresies, and that even should he recant he ought never to be allowed to preach or teach again or to return to Bohemia, but that should he refuse recantation there was no remedy but the stake. During the next four weeks no effort was spared to shake the determination of Huss; but the spirit of the martyr rose within him as he saw his end approaching, and he steadfastly refused to swerve from the path which conscience had once made clear. "I write this," says he, in a letter to his friends at Prague, "in prison and in chains, expecting to-morrow to receive sentence of death, full of hope in God that I shall not swerve from the truth, nor abjure errors imputed to me by false witnesses." The sentence he expected was pronounced on July 6th in the presence of the emperor and a full sitting of the council; once and again he attempted to remonstrate, but in vain, and finally he betook himself to silent prayer. After he had undergone the ceremony of degradation with all the childish formalities which are usual on such occasions, his soul was formally consigned by all those present to the devil, while he himself with clasped hands and uplifted eyes reverently committed it to Christ. He was then handed over to the secular arm, and immediately led off to the place of execution, the council meanwhile proceeding unconcernedly with the rest of its business for the day. Many touching incidents recorded in the histories make manifest the meekness, fortitude, and even cheerfulness with which he went to his dreadful death. After he had been tied to the stake and the fagots had been piled, he was for the last time urged to recant, but his only reply was:—"God is my witness that I have never taught or preached that which false witnesses have testified against me. He knows that the great object of all my preaching and writing was to convert men from sin. In the truth of that gospel which hitherto I have written, taught, and preached, I now joyfully die." The fire was then kindled, and his voice as it audibly prayed in the words of the "Kyrie Eleison" was soon stifled in the smoke. When the flames had done their office, the ashes that were left and even the soil on which they lay were carefully removed and thrown into the Rhine.

Not many words are needed to convey a tolerably adequate estimate of the character and work of the "pale, thin man in mean attire," who in sickness and poverty thus completed the forty-sixth year of a busy life at the stake. Huss was much less remarkable for the amount of his mental endowments and acquirements than for the candor with which he formed his convictions, the tenacity with which he held them, the unselfish enthusiasm with which he spoke them. He cannot be said to have added a single new item to the intellectual wealth of the world, but his contribution to its moral capital was immense. It might not be easy to

formulate very precisely the doctrines for which he died, and certainly some of them, as, for example, that regarding the church, were such as many Protestants even would regard as unguarded and difficult to harmonize with the maintenance of external church order; but his is undoubtedly the honor of having been the chief intermediary in handing on from Wickliffe to Luther the torch which kindled the Reformation, and of having been one of the bravest of the martyrs who have died in the cause of honesty and freedom, of progress and of growth toward the light.

HUSSITES. The arbitrary arrest and imprisonment of Huss at Constance in November, 1415, created a very painful impression among all classes in Moravia and Bohemia, and called forth angry remonstrances as soon as it was known. While the nobles resorted to diplomacy, the masses rioted and in many instances attacked the clergy. The excitement was immensely intensified by the tidings of his death, which was freely characterized as a judicial murder; several priests were put to death by the infuriated populace, who cherished the memory of Huss as that of a patriot and a saint; and the archbishop himself, after having been beset in his own palace, with difficulty saved his life by flight. Public feeling found its first organized expression in a diet which was hastily summoned to meet at Prague early in September; there a solemn protest, ultimately signed by 452 magnates and barons, was drawn up, in which the personal character of Huss as man, teacher, preacher, and author was warmly upheld, and the freedom of Bohemia and Moravia from error and heresy was as energetically asserted. Three days later the nobles who had signed this document formed themselves into a league, headed by two Bohemian barons and one from Moravia, by which they bound themselves to protect liberty of preaching on their estates, and to yield obedience to bishop or pope only in so far as might be in accordance with Scripture and the will of God. Matters of dispute were to be subjected to the arbitration of the rector and doctors in theology of the university of Prague. Soon afterward a counter league was formed for the support of the council and curia; and civil war appeared to be imminent. The tension was further increased by the arrival of the bishop of Leitomischl, long the enemy of Huss, as legate from the council for the extirpation of heresy; and by the pressure of the interdict under which the city of Prague continued to lie. In February, 1416, the 452 nobles who had signed the protest in favor of Huss were summoned to appear before the council, while the anti-Hussite league was encouraged to prepare for a crusade; and the burning of Jerome of Prague in the following May still further revealed the prevailing disposition of Catholic Christendom. Owing to the slowness, however, with which matters moved at Constance, it was not until February, 1418, that the new pope, Martin V. (Otto di Colonna), was able to issue various bulls and briefs, in which he laid all obstinate Hussites under the ban, and called upon all the ecclesiastical and civil authorities to proceed against them. The council also, shortly before its dissolution, drew up twenty-four articles for withdrawing the Bohemians from the prevailing heresy, bidding King Wenceslaus protect the rights of the Romish Church in his dominion, restore the banished clergy to their benefices, repress the Hussite preaching and hymn-singing, dissolve the Hussite associations, and take the ringleaders into custody. To this policy the king, after much vacillation, began to give effect early in 1419, and forthwith the more prominent Hussites withdrew from court; among these were Nicolaus of Pistna, an able statesman, and the famous John Zizka, a practiced soldier, who placed themselves at the head of the malcontents.

By the end of the year the war, though it is usually reckoned from 1420, may be said to have begun. It divides itself into two periods—the defensive, which lasted from 1420 to 1425, and the offensive, which began with Procopius' invasion of Germany, in 1427, and lasted until the commencement of negotiations with the council of Basel, in 1431. The struggle had not proceeded very far, however, before it became manifest that the Hussite party was itself sharply divided in views and aims. All were agreed in warm and tender reverence for the memory of Huss, the evangelical preacher and the faithful servant of Christ; equally unanimous were they in holding the distinctive doctrine of the supreme authority of Holy Scripture, and in urging the reformation of the church. But all were not prepared to go equally far in the amount of reform they proposed. While the more radical section rejected such doctrines as those of purgatory and of the mediation of saints, held that priests in mortal sin could validly administer no sacrament, disapproved of penances, images, relics, mass in a foreign tongue, maintained the right of the pious laity, even of women, to preach, and regarded every building as in itself at least suitable for acts of divine worship, the more moderate or conservative section formulated their much simpler programme in the famous four articles of Prague (July, 1420). These were: (1) free preaching of the word of God throughout the kingdom of Bohemia; (2) the administration of the eucharist to all believers not in mortal sin, under both species according to the institution of Christ; (3) deprivation of the clergy of the secular lordship they had assumed, and of the secular property they had acquired to their own injury and to the prejudice of the civil power; (4) prohibition and repression of all mortal sins and public scandals. The supporters of these articles, who were led by Baron Czenko of Wartenberg, and had in their number such men as Jakob von Mies, were strong in the town and university of Prague, and occasionally received the name of the Praguers, but ultimately came to be more generally known as Calixtines (from "calix") or Utraquists (from their claim to receive the communion "sub utraque specie"). The more radical party, from having taken up their headquarters at a stronghold which had been fortified by Zizka and called Mount Tabor, some sixty-five miles southward of Prague, received the name of Taborites. Whatever differences, however, may have separated the Hussites, all were united in offering resistance to the efforts made by Sigismund to crush them; and at Deutschbrod in 1422, at Aussig in 1426, and finally at Taus (August 14, 1431), they inflicted signal defeats on his troops. Negotiations begun in 1431 with the council of Basel reached a termination only in November, 1433, when the so-called "Compactata" or articles of agreement were signed by which the Calixtines were satisfied, communion under both species being granted to all who desired it, although the other concessions in the direction of the four articles of Prague were made in a somewhat illusory manner. The Taborites, or "Orphans" (as the followers of Zizka were sometimes called after his death in 1424), failed, however, to find in the Compactata all that they required, and they speedily took the field again in a campaign which terminated disastrously for them at Hrib near Böhmischbrod on May 30, 1434. In this battle both Procopius and his brother perished, and soon afterward the Taborites were compelled to surrender all the fortresses to which they had betaken themselves. Thenceforward they rapidly disappeared as a political party, although as a religious body they can be traced to about the middle of the century, when they gradually became

merged in the so-called Moravians, or United Brethren of Bohemia. The Calixtines obtained from Sigismund in 1436 the formal recognition of the Compactata, which from that time had the force of law. Satisfied with this somewhat empty achievement (which, however, was jealously guarded against the hostile attack of Pius II. in 1462), they gradually subsided into an inert conformity, so as to be but little distinguished from the Catholics around them. At the time of the Reformation some returned to the Roman Church, while the rest attached themselves either to the Lutheran or to the Reformed creed, and Hussitism as a distinct form of Christian profession became extinct.

HUSUM, a town in the Prussian province of Schleswig-Holstein, situated in a fertile district about two and a half miles inland from the German Ocean, on the canalized Huser Au, which forms its harbor and roadstead. Population, 6,267.

HUSZT, a market-town in the county of Máramaros, Hungary, is situated at the confluence of the Nagy-Ág with the Theiss, and about midway on the line of railway from Szatmár-Németi to Máramaros-Sziget.

HUTCHESON, FRANCIS, an eminent writer on mental and moral philosophy, was born on August 8, 1694. His birthplace was probably the townland of Drumalig, in the parish of Saintfield and county of Down, Ireland. He died in 1746.

In 1729 Hutcheson was elected as the successor of his old master, Gerschom Carmichael, to the chair of moral philosophy in the university of Glasgow. It is curious that up to this time both his essays and letters had all been published anonymously, though their authorship appears to have been perfectly well known.

HUTCHINSON, JOHN, a Puritan soldier, son of Sir Thomas Hutchinson, was born at Nottingham in September, 1616. After the Restoration he became member for the county of Nottingham, and he was included in the Act of Amnesty passed in favor of certain of the regicides. Subsequently, however, he was arrested upon suspicion of being concerned in a treasonable conspiracy; and after an imprisonment of ten months in the Tower of London, and of one month in Sandown Castle, Kent, he died September 11, 1664.

HUTCHINSON, JOHN, the author of *Moses' Principia* and other works in which the so-called Hutchinsonian system is expounded, was born at Spennithorne, Yorkshire, in 1674. He died in 1737.

HUTCHINSON, THOMAS, governor of the province of Massachusetts, son of a wealthy merchant of Boston, was born there September 9, 1711. The son, being unsuccessful in commerce, studied law, and adopted it as his profession. He was representative of Boston in the general court for ten years, and was three times chosen speaker. From 1749 to 1766 he was a counselor, in 1752 he was appointed judge of probate, from 1758 to 1771 he was lieutenant-governor, and in 1760 he became chief-justice. In 1748 he carried a measure to substitute gold and silver for the paper currency, which had depreciated one-eighth in value. During the Stamp Act riots of 1765 his house was sacked by the mob, and by his subsequent support of the general policy of the British Government he incurred increasing unpopularity. In 1767 he laid claim to a seat in the council on the ground of being lieutenant-governor, but on account of his political views his claims were set aside. On his appointment to the governorship of Massachusetts in 1769 he used every method to support the measures which the mother country sought to enforce against the colonists; and in December, 1773, on account of his refusal to permit the reshipment of teas on which a duty had been laid by the government, several of the inhabitants of Boston emptied the tea into the bay. In January, 1774,

Hutchinson asked leave to resign his office, and in June he sailed to England, where he spent the remainder of his life. As the result of official inquiry into his conduct while governor of Massachusetts, he was rewarded with a pension. He died at Brompton in June, 1780.

HUTCHINSON, the capital of Reno county, Kan., is situated on the Arkansas river, forty-five miles north-west of Wichita. Its population in 1880 was only 1,540, but at the last census it had increased to 8,682. The city has a taxable value of \$2,600,000. It contains thirteen churches and nine public school buildings (with 2,700 school children). The bonded debt is \$124,000. There are gas and water works, electric lights, and street railways, a stock yard, three packing-houses, a lard refinery and fifteen salt plants. It is the largest salt-producing center in the west.

HUTTEN, ULRICH VON (1488-1523), is one of those men who, like Erasmus or Pirckheimer, form the bridge between Humanists and Reformers. He lived with both, sympathized with both, though he died before the Reformation had time to fully develop itself. His life may be divided into four parts:—his youth and cloister-life (1488-1504); his wanderings in pursuit of knowledge (1504-1515); his strife with Ulrich of Württemberg (1515-1519); and his connection with the Reformation (1519-1523). He was born April 21, 1488, at the castle of Steckelberg, near Fulda, in Franconia. In 1509 the university of Greifswald welcomed him. Here too the friends who at first received him so kindly became his foes; the sensitive, ill-regulated youth, who took the liberties of genius, wearied his burgher patrons; they could not brook the poet's airs and vanity, and ill-timed assertions of his higher rank. Wherefore he left Greifswald, and as he went was robbed of clothes and books, his only baggage, by the servants of his late friends; in the dead of winter, half starved, frozen, penniless, he reached Rostock. Here again the Humanists, who were throughout full of charity and sympathy toward the luckless young scholar, received him gladly, and under their protection he wrote against his Greifswald patrons, thus beginning the long list of his satires and fierce attacks on personal or public foes. Rostock could not hold him long; he wandered on to Wittenberg and Leipsic, and thence to Vienna, where he hoped to catch the emperor Maximilian's favor by an elaborate national poem on the war with Venice. But neither Maximilian nor the university of Vienna would lift hand for him, and he passed into Italy, that Holy Land of Humanist enthusiasm, where, at Pavia, he sojourned throughout 1511 and part of 1512. In the latter year his studies were rudely interrupted by war; in the siege of Pavia by papal troops and Swiss, he was plundered by both sides, and escaped sick and penniless to Bologna; on his recovery he even took service as a private soldier in the emperor's army.

This dark period lasted no long time; in 1514 he was again in Germany, where, thanks to his poetic gifts and the friendship of Eitelwolf von Stein, he won the favor of the elector of Mainz, Archbishop Albert of Brandenburg. Here high dreams of a learned career rose on him; Mainz should be made the metropolis of a grand Humanist movement, the center of good style and literary form. This golden dream was scattered by the murder in 1515 of his cousin John of Hutten by Ulrich, duke of Württemberg. This outrage changed the whole course of Hutten's life; satire, chief refuge of the weak, became his weapon; with one hand he took his part in the famous *Epistolæ Obscurorum Virorum*, and with the other launched scathing letters, eloquent Ciceronian orations, or biting satires against the duke. Though the emperor was too lazy and indifferent to

smite a great prince, he condescended to bestow on Hutten the inexpensive honor of a laureate crown in 1517; as the poet tells us with pleased pride, the wreath was woven by the hands of fair Constantia, Conrad Peutinger's daughter. As recognized poet laureate of Germany, Hutten, who had been to Italy, again attached himself to the electoral court at Mainz; and he was there when in 1518 his true friend Pirckheimer wrote, urging him to abandon the court and dedicate himself to letters. We have the poet's long reply, in an epistle on his "way of life," an amusing mixture of earnestness and vanity, self-satisfaction and satire; he tells his friend that his career is just begun, that he has had twelve years of wandering, and will now enjoy himself awhile in patriotic literary work; that he has by no means deserted the humaner studies, but carries with him a little library of standard books. Pirckheimer in his burgher life may have ease and even luxury; he, a knight of the empire, how can he condescend to obscurity? He must abide where he can shine. And so, dazzled by his dream of an intellectual reform, Hutten chose the path which presently led him to his ruin.

In 1519 he issued in one volume his attacks on Duke Ulrich, and then, drawing sword, took part in the private war which overthrew that prince; in this affair he became intimate with Franz von Sickingen, the champion of the knightly order (Ritterstand). Henceforth Hutten takes part in the Lutheran movement, while he becomes mixed up in the attempt of the "Ritterstand" to recover its position, and to assert itself as the militia of the empire against the independence of the German princes. It was soon after this time that he discovered at Fulda a copy of the manifesto of the emperor Henry IV. against Hildebrand, and published it with comments as an attack on the papal claims over Germany. He hoped thereby to interest the new emperor Charles V., and the higher orders in the empire, in behalf of German liberties; but the appeal failed. What Luther had achieved by speaking to cities and common folk in homely phrase, because he touched heart and conscience, that the far finer weapons of Hutten failed to effect, because he tried to touch the more cultivated sympathies and dormant patriotism of princes and bishops, nobles and knights. And so he at once gained an undying name in the republic of letters and ruined his own career. He showed that the artificial verse-making of the Humanists could be connected with the new outburst of genuine German poetry. The Minnesinger was gone; the new national singer, a Luther or a Hans Sachs, was heralded by the stirring lines of Hutten's pen. These form a distinct epoch in the history of German national literature; they have in them a splendid natural swing and ring, strong and patriotic, though unfortunately addressed to knight and landsknecht rather than to the German people.

The poet's high dream of a knightly national regeneration had a rude awakening. The attack on the papacy, and Luther's vast and sudden popularity, frightened Elector Albert, who dismissed Hutten from his court. Hoping for imperial favor, he betook himself to Charles V.; but that cold young prince, who cared little for Humanists, and was not a German, would have none of him. So he returned to his friends, and they rejoiced greatly to see him still alive; for Pope Leo X. had ordered him to be arrested and sent to Rome, and assassins dogged his steps. He now attached himself more closely to Franz von Sickingen and the knightly movement. This also came to a disastrous end in the capture of the Ebernberg, and Sickingen's death; the higher nobles had triumphed; the archbishops avenged themselves on Lutheranism as interpreted by the knightly order. With Sickingen, Hutten also finally fell. He

fled to Basel, where Erasmus refused to see the sick hero, both for fear of his loathsome diseases, and also because the beggared knight was sure to borrow money from him. A paper war consequently broke out between the two Humanists, which embittered Hutten's last days, and stained the memory of Erasmus. From Basel Ulrich dragged his limbs to Mulhausen; and when the vengeance of Erasmus drove him thence, he went to Zurich. There the large heart of Zwingli welcomed him; he helped him with money, and found him a quiet refuge with the pastor of the little isle of Ufnau on the Zurich Lake. There the frail and worn-out poet, writing swift satire to the end, fell a victim to his infirmities, and died (August 29, 1523), at the age of thirty-five. He left behind him some debts due to compassionate friends; he did not even own a single book, and all his goods amounted to the clothes on his back, a bundle of letters, and that valiant pen which had fought so many a sharp battle, and had won for the poor knight-errant a sure place in the annals of literature.

HUTTON, CHARLES, the youngest son of Henry and Eleanor Hutton, was born at Newcastle-on-Tyne, August 14, 1737. He died on January 27, 1823.

HUTTON, JAMES (1726-1797), one of the great founders of geological science, was born in Edinburgh on June 3, 1726. He studied for three years at Edinburgh, and completed his medical education by an attendance of nearly two years at the medical classes in Paris, returning by the Low Countries, and taking his degree of doctor of medicine at Leyden in 1749. At the end of that year he came back to England, only to find, however, that though he had qualified himself to practice as a medical man there seemed hardly any opening for him. In the summer of the ensuing year he definitely abandoned the idea of following out the medical profession, and, having inherited a small property in Berwickshire from his father, resolved to devote himself to agriculture. With the zeal and thoroughness characteristic of his disposition, he then went to Norfolk to learn the practical work of farming. Thereafter he extended his experience by a tour in Holland, Belgium, and the north of France. During these years he began to study the surface of the earth, looking into every pit, ditch, or river-bed that he saw, and gradually shaping in his mind the problem to which he afterward devoted his energies. In the summer of 1754 he established himself on his own farm in Berwickshire, where he resided for fourteen years, and where he introduced the most improved forms of husbandry. As the farm was brought into excellent order, and as its management, becoming more easy, grew less interesting, he was finally induced to let it, and establish himself for the rest of his life in Edinburgh. This took place about the year 1768.

From this period until his death in 1797 he lived unmarried with his three sisters. Surrounded by congenial literary and scientific friends, he devoted himself to those researches which have had so important an influence upon the progress of science. At that time geology in any proper sense of the term did not exist. Mineralogy, however, had made considerable progress. Hutton's taste for chemistry naturally led him into mineralogy. But he had conceived larger ideas than were entertained by the mineralogists of his day. He desired to trace back the origin of the various minerals and rocks, and thus to arrive at some clear understanding of the history of the earth. For many years he continued to ponder over the subject, making during that time many excursions to different parts of the country to obtain materials for his researches, or to test the hypotheses he had been led to form. At last, in the spring of the year 1785 he communicated his views to the

recently established Royal Society of Edinburgh in a paper entitled *Theory of the Earth, or an Investigation of the Laws Observable in the Composition, Dissolution, and Restoration of Land upon the Globe*. In this remarkable work the doctrine is expounded that geology is not cosmogony, but must confine itself to the study of the materials of the earth; that everywhere evidence may be seen that the present rocks of the earth's surface have been formed out of the waste of older rocks; that these materials having been laid down under the sea were there consolidated under great pressure, and were subsequently disrupted and upheaved by the expansive power of subterranean heat; that during these convulsions veins and masses of molten rock were injected into the rents of the dislocated strata; that every portion of the upraised land, as soon as exposed to the atmosphere, is subject to decay; and that this decay must tend to advance until the whole of the land has been worn away and laid down on the sea-floor, whence future upheavals will once more raise the consolidated sediments into new land. In some of these broad and bold generalizations Hutton was anticipated by the Italian geologists; but to him belongs the credit of having first perceived their mutual relations, and combined them in a luminous, coherent theory everywhere based upon observation.

It was not merely the ground beneath us to which Hutton directed his attention. He had long studied the changes of the atmosphere. The same volume in which his *Theory of the Earth* appeared contained also a *Theory of Rain*, which was read to the Royal Society of Edinburgh in February, 1784. He contended that the amount of moisture which the air can retain in solution increases with augmentation of temperature, and therefore that on the mixture of two masses of air of different temperatures a portion of the moisture must be condensed and appear in visible form. He investigated the data available in his time regarding rainfall and climate in different regions of the globe, and came to the conclusion that the rainfall is everywhere regulated by the humidity of the air on the one hand, and the causes which promote mixtures of different aerial currents in the higher atmosphere on the other.

The vigor and versatility of his genius may be understood from the variety of works which, during his thirty years' residence in Edinburgh, he gave to the world. In the year 1792 he published a quarto volume entitled *Dissertations on different Subjects in Natural Philosophy*, in which he discussed the nature of matter, fluidity, cohesion, light, heat, and electricity. Some of these subjects were further illustrated by him in papers read before the Royal Society of Edinburgh. His closing years were devoted to the extension and republication of his *Theory of the Earth*, of which two volumes octavo appeared in 1795. A third volume, necessary to complete the work, was left by him in manuscript, and is referred to by his biographer Playfair, but seems to have disappeared. No sooner had this task been performed than he set to work to collect and systematize his numerous writings on husbandry, which he proposed to publish under the title of *Elements of Agriculture*. He had nearly completed this labor when an incurable disease brought his active career to a close on March 26, 1797.

HUY, in Flemish HOEY, a town of Belgium, at the head of an arrondissement in the province of Liège, situated in the most romantic portion of the Meuse valley near the confluence of the Hoyoux, on the railway between Liège and Nemur, and about twenty miles west of the former city. It lies on both banks of the river, and the two portions are united by a bridge about 460 feet long. Population, 13,403.

HUYGENS, CHRISTIAAN, mathematician, mechanician, astronomer, and physicist, was born at the Hague, April 14, 1629. From his father Christiaan received the rudiments of his education, which was continued at Leyden under Vinnius and Schooten, and completed in the juridical school of Breda. His mathematical bent, however, soon diverted him from his legal studies, and the perusal of some of his earliest theorems enabled Descartes to predict his future greatness. In 1649 he accompanied the mission of Henry, count of Nassau, to Denmark, and in 1651 entered the lists of science as an assailant of the unsound system of quadratures adopted by Gregory of St. Vincent. This first essay (*Exetasis quadraturæ circuli*, Leyden, 1651) was quickly succeeded by his *Theoremata de quadratura hyperboles, ellipsis, et circuli*; while, in a treatise entitled *De circuli magnitudine inventa*, he made, three years later, the closest approximation hitherto obtained to the ratio of the circumference to the diameter of a circle.

But another class of subjects was about to engage his attention. The improvement of the telescope was then justly regarded as a *sine qua non* for the advancement of astronomical knowledge. Owing, however, to the difficulties interposed by spherical and chromatic aberration, little progress had been made in that direction when, in 1655, Huygens, working with his brother Constantin, hit upon a new method of grinding and polishing lenses. The immediate results of the clearer definition obtained were the detection of a satellite to Saturn (the sixth in order of distance from its primary), and the resolution into their true form of the abnormal appendages to that planet. Each discovery in turn was, according to the prevailing custom, announced to the learned world under the veil of an anagram—removed, in the case of the first, by the publication, early in 1656, of the little tract *De Saturni luna observatio nova*; but retained, as regards the second, until 1659, when in the *Systema Saturnium* the varying appearances of the so-called “triple planet” were clearly explained as the phases of a ring inclined at an angle of 20° to the ecliptic. His application of the pendulum to regulate the movement of clocks was another fruit of his astronomical labors, springing, as it did, from his experience of the need for an exact measure of time in observing the heavens. The invention dates from 1656; the *Horologium*, containing a description of the requisite mechanism, was published in the following year, and on June 16, 1657, Huygens presented his first “pendulum-clock” to the States-General.

His reputation now became cosmopolitan. As early as 1655 the university of Angers had distinguished him with an honorary degree of doctor of laws. In 1663, on the occasion of his second visit to England, he was elected a fellow of the Royal Society, and imparted to that body in January, 1669, a clear and concise statement of the laws governing the collision of elastic bodies. Although these conclusions were arrived at independently, and as it would seem, several years previous to their publication, they were in great measure anticipated by the communications on the same subject of Wallis and Wren, made respectively in November and December, 1668.

Huygens had before this time fixed his abode in France. In 1665 Colbert made to him on behalf of Louis XIV. an offer too tempting to be refused, and between the following year and 1681 his residence in the philosophic seclusion of the Bibliothèque du Roi was only interrupted by two short visits to his native country. His *magnum opus* dates from this period. The *Horologium Oscillatorium*, published with a dedication to his royal patron in 1673, contained original discover-

ies sufficient to have furnished materials for half a dozen striking disquisitions. His solution of the celebrated problem of the “center of oscillation” formed in itself an important event in the history of mechanics. Assuming as an axiom that the center of gravity of any number of interdependent bodies cannot rise higher than the point from which it fell, he arrived, by anticipating in the peculiar case the general principle of the conservation of *vis viva*, at correct although not strictly demonstrated conclusions. His treatment of the subject is especially noteworthy as being the first successful attempt to deal with the dynamics of a system. The determination of the true relation between the length of a pendulum and the time of its oscillation; the invention of the theory of evolutes; the discovery, hence ensuing, that the cycloid is its own evolute, and is strictly isochronous; the ingenious although practically inoperative idea of correcting the “circular error” of the pendulum by applying cycloidal checks to clocks—were all contained in this remarkable treatise. The theorems on the composition of forces in circular motion with which it concluded formed the true prelude to the *Principia*, and would alone suffice to establish the claim of Huygens to the highest rank among mechanical inventors.

In 1681 he finally severed his French connections, and returned to Holland. The harsher measures which about that time began to be adopted towards his co-religionists in France are usually assigned as the motive of this step. He now devoted himself during six years to the production of lenses of enormous focal distance, which, mounted on high poles, and connected with the eyepiece by means of a cord, formed what were called “aërial telescopes.” Three of his object glasses, of respectively 123, 180 and 210 feet focal length, are still in the possession of the Royal Society. He also succeeded in constructing an almost perfect achromatic eyepiece, still known by his name. But his researches in physical optics constitute his chief title-deed to immortality. Although Hooke first proposed the wave theory of light, Huygens gave reality to the conception, establishing it on a foundation so sure that it has never since been shaken. His powerful scientific imagination enabled him to perceive that an undulation may be broken up into an indefinite number of parts, each of which is the origin of a partial wave, and that the aggregate effect of all these partial waves will reconstitute the primary wave at any stage of its progress. This resolution of the main undulation is the well-known “principle of Huygens,” and by its means he was enabled to prove the fundamental laws of optics, and to assign the correct construction for the direction of the extraordinary ray in uniaxial crystals. These investigations, together with his discovery of the “wonderful phenomenon” of polarization, are recorded in his *Traité de la Lumière*, published at Leyden in 1690, but composed in 1678. In the appended treatise *Sur la Cause de la Pésanteur*, he rejected gravitation as a universal quality of matter, although admitting the Newtonian theory of the planetary revolutions. From his views on centrifugal force he deduced the oblate figure of the earth, estimating its compression, however, at little more than one-half its actual amount.

Huygens was never married. He died at the Hague, June 8, 1695, bequeathing his manuscripts to the university of Leyden, and his considerable property to the sons of his younger brother.

HUYGENS, SIR CONSTANTIJN or CONSTANTIN, Dutch poet and diplomatist, was born at the Hague, September 4, 1596. Huygens edited his poems for the last time in 1672, and died in his ninety-first year, on March 28, 1687.

HUYSMANS. Four painters of this family matriculated in the Antwerp guild in the seventeenth century. Cornelis the elder, apprenticed in 1633, passed for a mastership in 1636, and remained obscure. Jacob, apprenticed to Frans Wouters in 1650, wandered to England toward the close of the reign of Charles II., and competed with Lely as a fashionable portrait painter. Jan Baptist Huysmans, born at Antwerp in 1654, matriculated in 1676-77, and died there in 1715-16. He was younger brother to Cornelis Huysmans the second, who was born at Antwerp in 1648, and educated by Gaspar de Wit and Jacob van Artois.

HUYSUM, JAN VAN, artist, was born at Amsterdam, in 1662, and died in his native city February 8, 1749.

HWEN T'SANG is the most eminent representative of a remarkable and valuable branch of Chinese literature, known during the last half-century, chiefly through the labors of Continental scholars.

Hwen T'sang was born in the district of Keu-Shi, near Honan-Fu, about 605, a period at which Buddhism appears to have had a powerful influence upon a large body of educated Chinese. In 664 Hwen T'sang died in a convent at Chang-ngan. Some things in the history of his last days, and in the indications of beatitude recorded, strongly recall the parallel history of the saints of the Roman calendar. But on the other hand we find the Chinese saint, on the approach of death, causing one of his disciples to frame a catalogue of his good works, of the books that he had translated or caused to be transcribed, of the sacred pictures executed at his cost, of the alms that he had given, of the living creatures that he had ransomed from death. "When Kia-shang had ended writing this list, the master ordered him to read it aloud. After hearing it the devotees clasped their hands, and showered their felicitations on him." Thus the "well-done, good and faithful," comes from the servant himself in self-applause.

HYACINTH, also called **JACINTH**, one of the most popular of garden flowers, "supreme among the flowers of spring." It is no new favorite, having been in cultivation prior to 1597, at which date Gerard records the existence of six varieties, which are not indicated as particularly rare or novel.

The original of the cultivated hyacinth, *Hyacinthus orientalis*, is by comparison an insignificant plant, bearing on a spike only a few small, narrow-lobed washy blue flowers. So great has been the improvement effected by the florists, and chiefly by the Dutch, that the modern hyacinth would scarcely be recognized as the descendant of the type above referred to, the spikes being long and dense, composed of a large number of flowers; the spikes produced by strong bulbs not unfrequently measure six or seven inches in length and from seven to nine inches in circumference, with the flowers closely set on from bottom to top. Of late years much improvement has been effected in the size of the individual flowers and the breadth of their recurving lobes, as well as in securing increased brilliancy and depth of color.

The first hyacinths were single-flowered, but toward the close of the seventeenth century double-flowered ones began to appear, and till a recent period these bulbs were the most esteemed. At the present time, however, the single-flowered sorts are in the ascendant, as they produce more regular and symmetrical spikes of blossom, the flowers being closely set and more or less horizontal in direction, while most of the double sorts have the bells distant and dependent, so that the spike is loose and by comparison ineffective. For pot culture, and for growth in water-glasses especially, the single-flowered sorts are greatly to be preferred. Few if any

of the original kinds are now in cultivation, a succession of new and improved varieties having been raised, the demand for which is regulated in some respects by fashion. At the present day our nurserymen offer in their annual catalogues of select sorts between two and three hundred distinct varieties.

The earliest of all the hyacinths, and one which is very valuable for forcing into flower in winter, is called the white Roman hyacinth. It is small-flowered, but very sweet, and if potted in September or October, as soon as the bulbs can be procured after importation, may easily be had in blossom by Christmas, when white flowers are so much sought after. Of course this is done with the aid of a forcing-house, but a very high temperature is not required. The best soil for pot hyacinths is made up of two parts turfy loam, one part decayed leaf-mold and one part well-decomposed cow-dung, with sand enough to make it porous, and with sufficient drainage.

The name of hyacinth is applied to several other plants having bulbous roots. The Cape hyacinth is *Scilla corymbosa*; the grape hyacinth, *Muscari botryoides*; the tassel hyacinth, *Muscari comosum*, and the feathered hyacinth, *Muscari comosum monstrosum*; the starch hyacinth, *Muscari racemosum*; the star hyacinth, *Scilla amœna*; the lily hyacinth, *Scilla Liliohyacinthus*; the hyacinth of Peru, *Scilla peruviana*; the wild hyacinth or blue-bell, *Hyacinthus non scriptus*; the wild hyacinth of America, *Camassia esculenta*; the Missouri hyacinth, *Hesperoscordum lacteum*; and the native hyacinth of Tasmania, *Thelymitra media*.

HYACINTHUS, a mythological figure connected with the Hyacinthia, a festival celebrated by the Spartans in honor of Apollo of Amyclæ, whose primitive image, standing on a throne, is described by Pausanias. The sister of Hyacinthus is Polyboea, the much nourishing fertility of the rich Amyclæan valley; while his brother is Cynortas, the rising of the dog (the hot) star. But with the death of the spring is united the idea of its certain resuscitation in a new year; like Dionysus, the hero is not merely dead, but elevated to heaven. The festival took place on the three hottest days of summer, 7th to 10th of the month Hecatombeus (which was called, in Sicily, Hyacinthius), and its rites were a mixture of mourning and rejoicing.

HYADES, five stars forming the head of the larger constellation, the Bull. Their rising along with the sun marks the opening of the rainy season, hence their name Hyades—the Rainy.

HYÆNA (*Hyænidae*), a family of digitigrade carnivorous mammals, approaching the *Felidae* or cats in the character of the dentition, while resembling the *Viverridae* or civets in the possession of a glandular pouch beneath the anus, and therefore usually classed as a transition group between these two families. It comprises a single genus (*Hyæna*), and three species, which resemble each other and differ from all other carnivores in having both pairs of feet with four toes each. They are further characterized by the greater length of their fore legs as compared with those behind, by their well-developed although non-retractile claws, by their prickly, cat-like tongue, and by the enormous strength of their jaws and teeth, which enables them to break open the hardest bones, and to retain what they have seized with the most unrelaxing grip.

The Striped Hyæna (*Hyæna striata*) is the most widely distributed and best known form, being found throughout India, Persia, Asia Minor, and the northern half of Africa, while, if the strand wolf (*Hyæna villosa*) of the Cape colonists is only a variety of this species, as many naturalists suppose, its range will be thereby extended to the southern extremity of the African continent. It

resembles a wolf in size, and is of a grayish-brown color, marked with indistinct longitudinal stripes of a darker hue, while the legs are transversely striped as in the zebra. The hairs on its body are long, especially on the ridge of the neck and back, where they form a distinct mane, which is continued along the tail. The hyæna is nocturnal in its habits, preferring by day the gloom of caves and ruins, or of the burrows which it occasionally forms, but coming forth at sunset to make night hideous with its unearthly howling, which, when the animal is excited, changes into what has been compared to demoniac laughter, and hence the name of "laughing hyæna," by which it is also known. The food of those creatures consists chiefly of carrion, and they thus perform a highly useful service in hot countries by devouring the remains of dead animals which might otherwise pollute the air. So ravenous, however, are they that even the bodies of the buried dead are not safe from their attacks, their powerful claws enabling them to gain access to the newly interred bodies in the Eastern cemeteries, which they are said habitually to frequent. They also feed on the flesh of animals, which they hunt in packs. When driven by hunger they have thus been frequently known to enter villages by night and to carry off such domestic animals as they might chance to find. Bruce, the African traveler, states that everywhere in Abyssinia they were a plague. "Gondar," he says, "was full of them from the time it turned dark till the dawn. In short, the hyæna was the plague of our lives, the terror of our night walks, the destruction of our mules and asses, which above all others are his favorite food." Although, in proportion to its size, possessing probably the most powerful teeth and jaws in the whole mammalian series, the pusillanimity of the hyæna is such as to prevent its attacking animals greatly inferior to itself in strength. The Arab, for this reason, holds it in contempt; and, when he condescends to hunt the hyæna, he does not waste his ammunition upon it, but runs it down with dogs. It has usually been regarded as untamable; this, however, is not the case, for when properly treated in captivity, it has been known to exhibit the greatest docility and attachment to its keepers; and Colonel Sykes states that in certain districts of central India where those creatures abound they are as susceptible of domestication as ordinary dogs.

The Spotted Hyæna (*Hyæna crocuta*) takes the place of the striped species in the southern half of the African continent, to which it is confined. It resembles the other in size, but differs from it considerably in appearance, the stripes of the one being replaced by dark brown spots on a yellowish ground in the other, while in the "tiger-wolf," as this species is called at the Cape, the mane is much less distinct. According to Schweinfurth, who met with it in the heart of Africa, it is a much more powerful and savage animal than the northern form. Although averse to hunting living prey, it takes to the chase when carrion is not to be had, and the same traveler was on one occasion startled by a spotted hyæna which darted past him, like lightning, in pursuit of an antelope. At the Cape it was formerly very common, and occasionally committed great havoc among the cattle, while it did not hesitate to enter the Kaffre dwellings at night and carry off the child sleeping by its mother's side. By persistent trapping and shooting, its numbers have now been considerably reduced, with the result, however, of making it, like the hippopotamus of the same regions, exceedingly wary, so that it is not readily caught in any trap with which it has had an opportunity of becoming acquainted. Like the northern species, the spotted hyæna has been tamed, and has occasionally been trained to take the place of the dog. Its skin exhibits a considerable

variety of color and marking, and Schweinfurth found many skins in use among the Niamnians of Central Africa, in the form of aprons. The brown hyæna (*Hyæna rufa*) is also a native of South Africa.

Although hyænas are now confined to the warmer regions of the Old World, their fossil remains show that they had a much more northerly range during Tertiary times. Abundant remains of a larger species than any now living have been found in the caves of England, France, and Germany. This species, known as the cave hyæna (*Hyæna spelæa*), is supposed to have been most nearly allied to the spotted hyæna of South Africa, but does not appear to have extended farther south than the middle of Europe. Remains which have been doubtfully identified as belonging to the striped species have also been found in the south of France, and others in Sicily and Algeria, undoubtedly belonging to the spotted form of South Africa, which must thus have had a much more northerly extension in Tertiary times. No remains of the hyæna are known to occur in the New World.

HYBLA is the name of several cities in Sicily. A Sicilian goddess was named Hyblæa; hence doubtless the name was so common. The Hybla of which we hear most was founded by the Megarians, about the year 726 B.C., and is probably the same as Megara Hyblæa. For some time it was a flourishing city; a century after its foundation it founded in its turn the colony of Selinus. But about the year 481 B.C. it was completely destroyed by Gelon, tyrant of Syracuse. The mass of the inhabitants were sold as slaves; the richer were transported to Syracuse and there admitted as citizens.

HYBRIDISM. The Latin word *hybrida*, or *lubrida*, a hybrid or mongrel, is commonly derived from the Greek *ὑβρις*, an insult or outrage, with special reference to lust; hence an outrage on nature, a mongrel.

As a general rule animals or plants belonging to distinct species are not able, when crossed with each other, to produce offspring. There are, however, innumerable exceptions to this rule; and hybridism is the word employed to denote these exceptions. It is an abstract term which signifies the more or less fertile crossing of distinct species. In scientific usage, the term "hybrid" is exclusively reserved to denote the result of a fertile cross between two distinct species, while the term "mongrel" is the one which is as exclusively reserved to denote the result of a fertile cross between two varieties of the same species.

Until recently the interest attaching to hybridism was almost entirely of a practical nature, and arose from the fact, which is of considerable importance in horticulture, that hybrids are often found to present characters somewhat different from those of either parent species. But of late years the subject has acquired a high degree of scientific interest in relation to the theory of descent. On this account it has been so carefully and thoroughly treated by Mr. Darwin that a brief exposition of its main facts and principles must necessarily be little more than a condensation of his already closely packed material.

Looking first to the general facts and principles of hybridism, apart from their bearing upon the theory of descent, the following may be regarded as the most important:—

1. The laws governing the production of hybrids are identical, or nearly identical, in the animal and vegetable kingdoms.

2. The sterility which so generally attends the crossing of two specific forms is to be distinguished as of two kinds, which, although often confounded by naturalists, are in reality quite distinct. For the steril-

ity may obtain between the two parent species when first crossed, or it may first assert itself in their hybrid progeny. In the latter case the hybrids, although possibly produced without any appearance of infertility on the part of their parent species, nevertheless prove more or less infertile among themselves, and also with members of either parent species.

3. The degree of both kinds of infertility varies in the case of different species, and in that of their hybrid progeny, from absolute sterility up to complete fertility. Thus, to take the case of plants, "when pollen from a plant of one family is placed on the stigma of a plant of a distinct family, it exerts no more influence than so much inorganic dust. From this absolute zero of fertility, the pollen of different species, applied to the stigma of some one species of the same genus, yields a perfect gradation in the number of seeds produced, up to nearly complete, or even quite complete, fertility; so, in hybrids themselves, there are some which never have produced, and probably never would produce, even with the pollen of the pure parents, a single fertile seed; but in some of these cases a first trace of fertility may be detected, by the pollen of one of the pure parent species causing the flower of the hybrid to wither earlier than it otherwise would have done; and the early withering of the flower is well known to be a sign of incipient fertilization. From this extreme degree of sterility we have self-fertilized hybrids producing a greater and greater number of seeds up to perfect fertility."

4. Although there is, as a rule, a certain parallelism, there is no fixed relation between the degree of sterility manifested by the parent species when crossed and that which is manifested by their hybrid progeny. There are many cases in which two pure species can be crossed with unusual facility, while the resulting hybrids are remarkably sterile; and, contrariwise, there are species which can only be crossed with extreme difficulty, though the hybrids, when produced, are very fertile. Even within the limits of the same genus, these two opposite cases may occur.

5. When two species are reciprocally crossed, *i.e.*, male A with female B, and male B with female A, the degree of sterility often differs greatly in the two cases. The sterility of the resulting hybrids may differ likewise.

6. The degree of sterility of first crosses and of hybrids runs to a certain extent, parallel with the systematic affinity of the forms which are united. "For species belonging to distinct genera can rarely, and those belonging to distinct families can never, be crossed. The parallelism, however, is far from complete; for a multitude of closely allied species will not unite, or unite with extreme difficulty, while other species, widely different from each other, can be crossed with perfect facility. Nor does the difficulty depend on ordinary constitutional differences; for annual and perennial plants, deciduous and evergreen trees, plants flowering at different seasons, inhabiting different stations, and naturally living under the most opposite climates, can often be crossed with ease. The difficulty or facility apparently depends exclusively on the sexual constitution of the species which are crossed, or on their sexual elective affinity."

Such being the principal facts of hybridism, we may next consider the relation which they bear to the theory of descent. It is obvious that the most important point of contact between the former and the latter consists in this—that, although hybridism is occasionally possible as an exception to the general infertility of species *inter se*, it is only, as it were, a partial exception; for, even when produced, the hybrid progeny almost invariably

manifest some greater or less degree of sterility, and this not only when crossed among themselves, but even when crossed with either of their parent species. The main facts of hybridism thus at first sight seem to support the time-honored doctrine that there are placed between all species the barriers of mutual sterility, for the purpose of preventing any admixture of specific qualities by heredity, and so for the purpose of maintaining the immutability of specific types. And the apparent support which this doctrine thus receives from the main facts of hybridism is still further strengthened when these facts are contrasted with those which are supplied by the breeding of our domestic "varieties." For, in the latter case, and as an almost invariable rule, neither the organisms when crossed nor their resulting progeny show any indications of sterility, although the two parent varieties may differ from one another even more widely than do many natural species which are wholly infertile when crossed. This very general distinction between natural species and domestic varieties has appeared to many competent persons in the present generation so profound and significant that they deem it to be in itself sufficient to discredit, if not to negative, the whole theory of the transmutation of species.

Now, when this distinction is thus posited as an objection to the theory of descent, we must first of all remember that this theory does not require the possibility of the commingling of specific types; it requires, indeed, that specific types should not be immutably fixed, but it does not require that the causes of their mutation should depend upon their mutual crossing. The whole difficulty, therefore, which the theory of descent has here to meet is to explain why it is that natural species are fenced about, as it were, with the mysterious barriers of sterility, while no such seeming care appears to have been taken in the case of our own domestic breeds—even though in the latter case artificial selection by the breeders may have produced more visible difference between the two parent races than that which natural selection is supposed to have produced between two natural species.

In answer to this difficulty, the most important consideration to begin with is one that is very generally lost sight of. The consideration is that mutual sterility between organic forms has been constituted by naturalists the chief criterion of specific distinction, and therefore it is merely to argue in a circle to maintain that specific distinction is of some transcendental nature *because* it is so invariably associated with this mutual sterility. If it were not for the fact of their mutual sterility, this and that species would probably not have been classified as such; and therefore it is now scarcely to be considered a matter of any great significance that all species present more or less of the peculiarity in virtue of which they are recognized as species. Or, otherwise stated, on the supposition that species have had a derivative origin, whenever the modification of a specific type has proceeded sufficiently far to induce sterility with allied types, the modified type is, *for this reason*, classified as a distinct species; otherwise, upon the supposition, the species could scarcely have become separated out as a distinct type. The argument which points to such sterility as evidence against this supposition is, therefore, so far inconclusive.

The case, however, ought not in fairness to be stated quite so strongly as this; for mutual sterility, although the chief, is not the only criterion of specific distinction. In forming their classifications, naturalists endeavor as much as possible to have regard to organisms in the totality of their structures and functions. It may therefore still be maintained that, although the above consideration as to mutual sterility being selected as the

this criterion of specific distinction greatly mitigates the force of the argument that natural species differ from artificial breeds in being more or less sterile with one another, still this consideration does not altogether destroy that argument. For, on the one hand, it is not mutual sterility alone which is taken as a test of specific distinction; and, on the other hand, it generally so happens that the other qualities distinctive of any given species do not differ more widely from those which are distinctive of allied species than is the case with many of our domestic breeds. It therefore still remains a significant circumstance that, *along with* the differences distinctive of natural species, there almost invariably goes the protective attribute of mutual sterility; while the possibly greater differences distinctive of our domestic breeds are unaccompanied by any such protective attribute. But, again, this more refined objection can be met and satisfactorily excluded by the general consideration that "as species rarely or never become modified in one character, without being at the same time modified in many, and as systematic affinity includes all visible resemblances and dissimilarities, any difference in sexual constitution between two species would naturally stand in more or less close relation with their systematic position."

But we are not confined to this general consideration alone. There are several other general considerations which tend still further to mitigate the difficulty, and there are several particular facts which together prove that the alleged distinction between natural species and domestic varieties is one, not of kind, but of degree. We shall, therefore, next proceed to state these general considerations and particular facts.

Upon the theory of descent, mutual sterility between specific types is nothing more than the expression of some certain amount of modification having taken place in the reproductive system of a changing form, which up to that time, and but for the fact of this modification, would have been classified by naturalists as a mere variety. Now the causes which act upon the reproductive system, both of animals and plants, and whether in the direction of sterility or prolificness, are at present hopelessly obscure. We cannot, therefore, expect to distinguish the causes which in the case of any given species have determined sterility. Nor is it necessary, for the meeting of the present difficulty, that this should be done; it is enough for this purpose to show that the causes which thus act upon the reproductive system are much too indistinct to admit of any argument being raised upon them. And this it is most easy to show; for it is not too much to say that the reproductive system is, generally speaking, of all parts of an organism the most delicately susceptible to slight changes in the conditions of life. Mr. Darwin has adduced a vast array of facts on this head in his *Variation of Animals and Plants Under Domestication*. As a result of this delicacy, there arises an apparent capriciousness in the ways and degrees in which the reproductive system is affected by slight changes in the conditions of life, by too close interbreeding, by grafting, and by many other causes. Thus, for example, the influences of domestication produce more or less sterility in numberless species of wild animals and plants, while in other species—and this, as we shall presently see, is a matter of great importance in the present connection—such influences are favorable to fertility. Now if we suppose, as in consistency we must suppose, that throughout the course of evolution the reproductive system has always been characterized by a sensitiveness to slight changes similar to that which we now observe, and if we remember that, in any case where these slight changes were sufficient to cause mutual sterility between

the modified descendants of a common progenitor, a distinction of species must necessarily have arisen, we shall cease to regard the present sterility of species *inter se* as anything more than what might be expected *a priori*, supposing the theory of descent with gradual modification to be true.

As evidence of the apparent capriciousness with which sterility may be manifested, owing to the slight and imperceptible causes on which it depends, special allusion must here be made to a highly remarkable and significant fact that has been brought to light by the direct experiments of Mr. Darwin. The following is his account of these experiments:—

"Several plants belonging to distinct orders present two forms, which exist in about equal numbers, and which differ in no respect except in their reproductive organs,—one form having a long pistil with short stamens, the other a short pistil with long stamens; both with differently-sized pollen grains. With trimorphic plants there are three forms likewise differing in the length of their pistils and stamens, in the size and color of the pollen grains, and in some other respects; and, as in each of the three forms there are two sets of stamens, there are altogether six sets of stamens and three kinds of pistils. These organs are so proportioned in length to each other that, in any two of the forms, half the stamens in each stand on a level with the stigma of the third form. Now I have shown, and the result has been confirmed by other observers, that in order to obtain full fertility with other plants, it is necessary that the stigma of the one form should be fertilized by pollen taken from the stamens of corresponding height in the other form. So that with dimorphic species two unions, which may be called legitimate, are fully fertile, and two which may be called illegitimate are more or less infertile. With trimorphic species six unions are legitimate or fully fertile, and twelve are illegitimate or more or less infertile. The infertility which may be observed in various dimorphic and trimorphic plants when they are illegitimately fertilized, that is, by pollen taken from stamens not corresponding in height with the pistil, differs much in degree up to absolute and utter sterility,—just in the same manner as occurs in crossing distinct species."

In this case we appear to have actual evidence of different stages of increasing sterility *in transitu*, and this even within the limits of the same natural species. And if even such evidence as this can be resisted, there still remains one very important fact, which directly affects the whole alleged distinction between the sterility of natural species and the fertility of domestic breeds. This fact is that plants belonging to several species of the genus *Passiflora* have been amply proved, not only to be completely fertile with plants belonging to other species, but even to be as completely infertile with plants belonging to their own. Thus fruit could not be obtained from *P. alata* and *P. racemosa* except by reciprocally fertilizing them with each other's pollen; and similar facts have been observed by several experimentalists with regard to four or five other specimens of this genus. The fullest details on the subject are those given by Mr. Scott in the *Journal of the Linnean Society*, vol. viii., p. 168. Plants belonging to three species of the genus, viz., *P. racemosa*, *carulea*, and *alata*, flowered for many years in Edinburgh, but, though repeatedly fertilized by Mr. Scott and others with their own pollen, never produced seed. But when mutually crossed in various ways they all produced seed.

These cases in the genus *Passiflora*, although so highly remarkable, are not wholly unique. There is not, indeed, any other case of a natural species, the members of which are only fertile with members of another

species; but there are several cases of natural species, the members of which are self-impotent, though freely fertile either with other plants of the same species, or with plants of different though allied species. This may perhaps be regarded as a transitional stage between the ordinary condition of plants and the extraordinary condition that obtains among species of the genus *Passiflora*. It occurs in individual plants of certain species of *Lobelia* and *Verbascum*, and among several genera of orchids. The cases of the latter are particularly remarkable, inasmuch as Fritz Müller found from numerous experiments, not only that individual plants belonging to the several species were not fertilized by their own pollen, while freely so by pollen taken from distinct species, and even from distinct genera, but that the plant's own pollen was positively deleterious to its stigma, and acted as a poison to the destruction of the flower.

So much, then, for the facts which go to prove on what slight constitutional differences sterility may depend, and the consequent probability there is that it should generally be found to accompany a change of organization which is sufficiently great to be regarded by naturalists as a specific distinction. But the pleading must not end here. For there still remains to be adduced the fact, already mentioned as one of the general facts of hybridism, that "the degree of both kinds of fertility varies in the case of different species, and in that of their hybrid progeny from absolute sterility up to complete fertility." As a matter of fact, the distinction between natural species and domestic varieties, upon which the whole discussion has hitherto proceeded, is in itself untenable; the infertility of natural species when crossed, although without question the general rule, is nevertheless not the invariable rule. We need not point to the highly anomalous case of *Passiflora* recently mentioned in another connection, and probably to be explained as the result of cultivation; for we appear to have sufficient evidence without it. It is true that a great deal of negative evidence has been published upon this point by very competent experimentalists; but it seems impossible to resist the positive evidence of the Hon. and Rev. W. Herbert, whose distinguished success in hybridizing Mr. Darwin attributes to "great horticultural skill, and to his having hothouses at his command." Of his many results, which from being of a positive kind can scarcely be suspected of inaccuracy, it will be enough to quote the following:—"Every ovule in a pod of *Crinum capense* fertilized by *C. revolutum* produced a plant, which I never saw to occur in a case of its natural fecundation." Thus, as Mr. Darwin in alluding to this case remarks, "we have perfect, or even more than commonly perfect, fertility in a first cross between two distinct species."

So far, then, as one side of the question before us is concerned, or that relating to the mutual infertility of natural species, enough has been said to show that it presents no real difficulty to the theory of descent. Indeed, in view of all that has now been said, the difficulty, as Mr. Darwin has observed, is not so much to account for the sterility of natural species, as it is to account for the continued, or even increased, fertility of our domestic varieties. Turning, therefore, to this other side of the question, we have to remember that the very same sensitiveness of the reproductive system, which in some cases leads to infertility under a change in the conditions of life, in other cases leads to increased fertility under an apparently similar change in the conditions of life. Thus it is that domestication produces such apparently capricious results with regard to fertility—inducing all degrees of infertility in some wild species, while not at all impairing, or even increasing,

fertility in others. Consequently, when the question is as to why our domestic varieties do not become sterile *inter se* when so many natural species have become so, the answer is that the mere fact of their domestication proves that their wild or parent stocks must have been some of those species whose reproductive systems were not highly sensitive to changes in their condition of life, and therefore species which "might be expected to produce varieties little liable to have their reproductive systems injuriously affected by the act of crossing with other varieties which had originated in a like manner." Thus, on the inherently necessary view that our domestic varieties have all proceeded from species which were not easily affected in the direction of sterility, we are not surprised that under variation their reproductive systems should continue to manifest a high degree of tolerance. To this must be added that domestication, if it does not produce sterility, seems well calculated to increase fertility. For if the causes inducing sterility (whatever they may be) are absent, ample and regular nutrition, combined with innumerable lesser benefits attending domestication, may well be supposed to favor fertility. And, as a matter of fact, according to Pallas, there is a great deal of evidence to indicate that prolonged domestication has a tendency to eliminate sterility; so that wild species which when first domesticated intercross with difficulty become in time able to intercross with facility. Such, for instance, appears to have been the case with the dog; for on the one hand all the domestic varieties of this animal are now freely fertile among themselves, and, on the other hand, there is independent evidence that these varieties have sprung from more than one natural species. Again, mention must not be omitted of the important fact that, although in the case of none of our varieties of domesticated animals is there any evidence of mutual sterility, yet among our varieties of domesticated plants a few cases have been observed of complete mutual sterility, which is in every way analogous to that which occurs between natural species. Thus, Gärtner observed this to be the case with certain varieties of maize and *Verbascum*, Kölreuter with one kind of tobacco, and other experimentalists with sundry varieties of gourd and melon. And here, let it be observed, we have the exact counterpart that evolutionists would desire to the experiments of Herbert above mentioned; for while he was able to break down the general distinction between natural species and domestic varieties on the side of proving perfect fertility between certain natural species, these experimentalists have broken down the distinction on the side of proving perfect sterility between certain of our domestic varieties. Therefore, we may conclude that this side of the question, or that as to the fertility of our domestic varieties, presents as harmless an aspect toward the theory of descent as we have already seen to be presented by the other side of the question, or that as to the sterility of natural species.

Finally, there are two complementary considerations to be adduced, which may now be stated together. One is that the general principles of hybridism, as briefly stated at the beginning of this article, are really far from indicative of having been instituted with any design of simply preventing species from intercrossing. For, upon the view that they were so instituted, scarcely any one of them admits of a rational explanation. Thus, upon this view, no reason can be assigned why the degree of sterility should be so extremely variable in different species, when it must be supposed equally important that all species should be kept distinct; nor can it be said why the degree of sterility should vary even among individuals of the same species. Neither can it be said why some species should cross with facil-

ity, and yet produce sterile hybrids, while other species cross with difficulty, and yet produce fertile hybrids. Why should species living in countries remote from one another, and therefore not able in a state of nature to come together, nevertheless prove as sterile *inter se* as species inhabiting the same country? Why, again, should there often be so great a difference in the result of a reciprocal cross between two species? Or why, indeed, should the production of hybrids have been permitted at all? As Mr. Darwin observes, "to grant to species the special power of producing hybrids, and then to stop their further propagation by different degrees of sterility, not strictly related to the facility of the first union between their parents, seems a strange arrangement."

The other and complementary consideration which has to be mentioned is, that on the counter supposition of all these general principles of hybridism being "simply incidental," or dependent on unknown differences in the reproductive systems of species—on this supposition we meet with sundry differences between wild species and domestic varieties, which are fully analogous to their difference of fertility, and which yet cannot reasonably be supposed to serve any transcendental purpose. Thus, again to quote Mr. Darwin:—

"Some allied species of trees cannot be grafted on each other—all varieties can be so grafted. Some allied animals are affected in a very different manner by the same poison, but with varieties no such case until recently was known, but now it has been proved that immunity from certain poisons stands in some cases in correlation with the color of the hair. The period of gestation generally differs much with distinct species, but with varieties until lately no such difference had been observed. The time required for the germination of seeds differs in an analogous manner, and I am not aware that any difference in this respect has as yet been detected with varieties. Here we have various physiological differences, and no doubt others could be added, between one species and another of the same genus, which do not occur, or occur with extreme rarity, in the case of varieties; and these differences are apparently wholly or in chief part incidental on other constitutional differences, just in the same manner as sterility of crossed species is incidental on differences confined to the sexual system. Why, then, should these latter differences, however serviceable they may indirectly be in keeping the inhabitants of the same country distinct, be thought of such paramount importance in comparison with other incidental and functional differences? No sufficient answer to this question can be given."

Upon the whole, therefore, it may be concluded that the difficulty which the facts of hybridism seem at first sight to raise against the theory of descent may be explained in harmony with the main requirements of that theory.

Animal Hybrids.—A few words may here be added with special reference to animal hybrids. As a general statement it may be said that hybrids, not only between specific but generic forms, are more easily produced in the case of animals than in that of plants. The hybrids, however, when produced are, as a general rule, more sterile. Indeed, it is doubtful whether there is any single instance of a perfectly fertile hybrid having emanated from a cross between two animal species. Mr. Darwin, however, says: "I have reason to believe that the hybrids from *Cervulus vaginalis* and *Reevesii*, and from *Phasianus colchicus* with *P. torquatus*, are perfectly fertile." Also M. Quatrefages states that the hybrid progeny of two moths (*Bombyx cynthia* and *B. arrindia*) showed themselves to be fertile *inter se* for eight generations. The hare and rabbit are said occa-

sionally to breed together, and their offspring to be highly fertile when crossed with either parent species. Lastly, Mr. Darwin observes:—

"The hybrids from the common and Chinese geese (*A. cygnoides*), species which are so different that they have sometimes been ranked in distinct genera, have often bred in this country with either pure parent, and in several instances *inter se*. This was effected by Mr. Eyton, who raised two hybrids from the same parents, but from different hatches; and from these two birds he raised no less than eight hybrids (grandchildren of the pure geese) from one nest. In India, however, these cross-bred geese must be far more fertile; for I am assured by two eminently capable judges, namely, Mr. Blyth and Captain Hutton, that whole flocks of these crossed geese are kept in various parts of the country; and, as they are kept for profit where neither pure parent-species exists, they must certainly be highly or perfectly fertile."

It is somewhat remarkable that hitherto direct experiments on the hybridization of animals have been so few in number as compared with those on the hybridization of plants. This is the more to be regretted, because, as already observed, animals appear to display a somewhat greater aptitude for hybridizing than plants, and consequently furnish better material for ascertaining the furthest limits of systematic affinity within which a cross may prove fertile. But here direct experiments are wanting, and all we can say with certainty is that in animals, as in plants, no authentic instance is on record of progeny resulting from a union of two individuals separated from one another by more than a generic distinction.

Graft-Hybridism.—The only other subject of importance that falls under the present heading is that which has been appropriately called "graft-hybridism." It is well known that, when two varieties or allied species are grafted together, each retains its distinctive characteristics. But to this general, if not universal, rule there are on record several alleged exceptions, in which either the scion is said to have partaken of the qualities of the stock, the stock of the scion, or each to have affected the other. Supposing any of these influences to have been exerted, the resulting product would deserve to be called a graft-hybrid. It is clearly a matter of great interest to ascertain whether such formation of hybrids by grafting is really possible; for, if even one instance of such formation could be unequivocally proved, it would show that sexual and asexual reproduction are essentially identical.

The cases of alleged graft-hybridism are exceedingly few, considering the enormous number of grafts that are made every year by horticulturists, and have been so made for centuries. Of these cases the most celebrated are those of Adam's laburnum (*Cytisus Adami*) and the bizzarria orange. Adam's laburnum is now flourishing in numerous places throughout Europe, all the trees having been raised as cuttings from the original graft, which was made by inserting a bud of the purple laburnum into a stock of the yellow. M. Adam, who made the graft, has left on record that from it there sprang the existing hybrid. There can be no question as to the truly hybrid character of the latter—all the peculiarities of both parent species being often blended in the same raceme, flower, or even petal; but until the experiment shall have been successfully repeated, there must always remain a strong suspicion that, notwithstanding the assertion and doubtless the belief of M. Adam, the hybrid arose as a cross in the ordinary way of seminal reproduction. Similarly, the bizzarria orange, which is unquestionably a hybrid between the bitter orange and the citron,—since it pre-

sents the remarkable spectacle of these two different fruits blended into one,—is stated by the gardener who first succeeded in producing it to have arisen as a graft-hybrid; but here again a similar doubt, similarly due to the need of corroboration, attaches to the statement. And the same remark applies to the still more wonderful case of the so-called trifacial orange, which blends three distinct kinds of fruit in one, and which is said to have been produced by artificially splitting and uniting the seeds taken from the three distinct species, the fruits of which now occur blended in the triple hybrid.

The other instances of alleged graft-hybridism are too numerous to be here noticed in detail; they refer to jessamine, ash, hazel, vine, hyacinth, potato, beet, and rose. Of these the cases of the vine, beet, and rose are the strongest as evidence of graft-hybridization, from the fact that some of them were produced as the result of careful experiments made by very competent experimentalists. On the whole, the results of some of these experiments, although so few in number, must be regarded as making out a strong case in favor of the possibility of graft-hybridism. For it must always be remembered that in experiments of this kind, negative evidence, however great in amount, may be logically dissipated by a single positive result.

HYDE, a township of England in the parish of Stockport, Cheshire, is situated near the river Tame and the Peak Forest canal, and on the Midland, and the Manchester, Sheffield, and Lincolnshire Railways, seven and one-half miles east from Manchester and six northeast from Stockport.

HYDE, EDWARD, Earl of Clarendon. See CLARENDON.

HYDE, THOMAS, a distinguished Orientalist, was born at Billingsley, near Bridgnorth, in Shropshire, June 29, 1636. Under Charles II., James II. and William III., Hyde discharged the duties of Eastern interpreter to the court. Worn out by his unremitting labors, he resigned his librarianship in 1701, and died at Oxford, February 18, 1703. Hyde was an excellent classical scholar, and there was hardly an Eastern tongue accessible to foreigners with which his wide erudition had not made him familiar.

HYDE PARK, a post-town of Norfolk county, Mass., seven miles south of Boston. It has some manufactories of machinery, paper and woolen goods, but is largely peopled by persons doing business in Boston. Population (1890), 10,193.

HYDER ALI, or HAIDAR 'ALI, the Mohammedan soldier-adventurer who, followed by his son Tippoo, became the most formidable Asiatic rival the English have ever had in India, was the great-grandson of a fakir or wandering ascetic of Islam who had found his way from the Punjab to Kulbarga in the south, and the second son of the Arab wife of a naik or chief constable at Budikote, near Colar, in Mysore, and was born about the beginning of the eighteenth century. The elder brother who, like himself, was early turned out into the world to seek his own fortune, became a naik, and ultimately rose to command a brigade in the Mysore army, while Hyder, who never learned to read or write, passed the first forty-seven years of his life aimlessly in sport and sensuality, sometimes, however, acting as the agent of his brother, and meanwhile acquiring a useful familiarity with the tactics of the French when at the height of their reputation under Dupleix. He is said to have induced his brother to employ a Parsee to purchase artillery and small arms from the Bombay Government, and to enroll some thirty sailors of different European nations as gunners, and is thus credited with having been "the first Indian who formed a corps of sepoy armed with firelocks and bayonets, and who had

a train of artillery served by Europeans." At the siege of Deonhully (1749) Hyder's services attracted the attention of Nunjeraj, the minister of the maharajah of Mysore, and he at once received an independent command; within the next twelve years his energy and ability had made him completely master of minister and maharajah alike, and in everything but in name he was ruler of the kingdom. In 1763 the conquest of Canara gave him possession of the treasures of Bednore, which he resolved to make the most splendid capital in India, under his own name, thenceforth changed from Hyder Naik into Hyder Ali Khan Bahadoor; and in 1765 he retrieved previous defeat at the hands of the Marhattas by the destruction of the Nairs or military caste of the Malabar coast, and the conquest of Calicut. Hyder Ali now began to occupy the serious attention of the Madras Government, which in 1766 entered into an agreement with the nizam to hold the district known as the Northern Circars from him, and to furnish him with troops to be used against the common foe. But hardly had this alliance been formed when a new and secret arrangement was come to between the two Indian powers, the result of which was that Colonel Smith's small force was met with a united army of 80,000 men and 100 guns. British dash and sepoy fidelity, however, prevailed, first in the battle of Changama (September 3, 1767), and again still more remarkably in that of Trinomalee, which lasted two days; and the nizam's own capital of Hyderabad was threatened by Colonel Peach's expedition sent from Bengal. On the loss of his recently made fleet and forts on the western coast, Hyder Ali now began to make overtures for peace; on the rejection of these, bringing all his resources and strategy into play, he forced Colonel Smith to raise the siege of Bangalore, and brought his army within five miles of Madras. The result was the treaty of April, 1769, providing for the mutual restitution of all conquests, and for mutual aid and alliance in defensive war; it was followed by a commercial treaty in 1770 with the authorities of Bombay. Under these arrangements Hyder Ali, when defeated by the Marhattas in 1772, claimed English assistance, but in vain; this breach of faith stung him to fury, and thenceforward he and his son did not cease to thirst for vengeance. His time came when in 1778 the English, on the declaration of war, resolved to drive the French out of India. The capture of Mahe on the coast of Malabar in 1779, followed by the annexation of lands belonging to a dependent of his own, gave him the needed pretext. Again master of all that the Marhattas had taken from him, and with empire extended to the Kistna, he now summoned the French to his assistance, and, descending through the Changama pass amid burning villages, reached Conjeveram, only forty-five miles from Madras, unopposed. Not till the smoke was seen from St. Thomas' Mount, where Sir Hector Munro commanded some 5,200 troops, was any movement made; then, however, the British general sought to effect a junction with a smaller body under Colonel Baillie recalled from Guntoor. The incapacity of these officers, notwithstanding the splendid courage of their men, resulted in the total loss of Baillie's force of 2,800 (September 10, 1780). Hastings, again appealed to, sent from Bengal Sir Eyre Coote, who, though repulsed at Chillumbrum, defeated Hyder thrice successively in the battles of Porto Novo, Polliloor, and Sholingur, while Tippoo was forced to raise the siege of Wandewash, and Vellore was provisioned. On the arrival of Lord Macartney as governor of Madras, the English fleet captured Negapatam, took Trincomalee from the Dutch, and forced Hyder Ali to confess that he could never ruin a power which had such command of the sea. He was

directing his attention to the west coast, where he sought the assistance of the French fleet, when his death took place suddenly at Chittore in December, 1782.

HYDERABAD ("the Territory of the Nizám"), an extensive realm of Southern India. This territory, inclusive of the Hyderabad Assigned Districts, known as Berar, is 475 miles in length from southwest to northeast, and about the same distance in breadth. The area of Berar is 17,728 square miles, and of the Nizám's Territories 81,807 square miles—the total area of the whole state being about 99,000 square miles.

HYDERABAD, the chief city and capital of the above state, is situated on the river Musí, and stands at a height of about 1,700 feet above sea-level. No census of the population has been taken, but it has been estimated at 200,000. The scenery around Hyderabad is wild and picturesque, the country being hilly and dotted with numerous granite peaks and isolated rocks. Approached from the west, the appearance of the city is very striking—the palace, the mosques, and the magnificent pile of buildings erected for the British residency towering above the outer wall. A large lake, a few miles south of Hyderabad, covering an area of 10,000 acres, supplies the town with water. The palace of the nizám, the mosques, and the British residency are the principal buildings. The palace has no pretensions to splendor, but is of considerable size. Hyderabad is a great Mohammedan stronghold, and contains several mosques.

HYDERABAD, or HAIDARBÁDÁ, a British district in the commissionership of Sind, India, with an area of 9,053 square miles. It is bounded north by Kairpur State, east by Thar and Párkár political superintendency, south by the same tract and the river Kori, and west by the river Indus and Karáchí district. The district is a vast alluvial plain, 216 miles long and 48 broad. Fertile along the course of the Indus, it degenerates toward the east into sandy wastes, sparsely populated and defying cultivation. The monotony is relieved by the fringe of forest which marks the course of the river, and by the avenues of trees that line the irrigation channels which branch eastward from this stream. The south of the district has a special feature in its large natural water-courses and basin-like shallows which retain the rains for a long time.

HYDERABAD, the chief town of the above district, had in 1881 a population of 123,675, and including the suburbs of 354,962. In the last ten years the population has increased rapidly. The municipal area is about fifteen square miles. Upon the site of the present fort is supposed to have stood the ancient town of Neránkot, which, in the eighth century, submitted to Muhammad Kásim Sakifí. Its situation near the apex of the delta of the Indus had commended itself to invaders and conquerors of still earlier date. It is identified with Patala, a town which has been connected with a prehistoric Scythian migration into India, (c. 625 B.C.?) Alexander the Great founded or refounded a city called Patala in or near the same place, 325 B.C., and left in it a military settlement. The best archæological authorities regard the modern Hyderabad as the representative of this Patala of the Greeks.

HYDRA (the name is also found as Sidra, Nidra, Idero, etc., and the ancient form was Hydrea), an island of Greece, lying about four miles off the southeast coast of Argolis in the Peloponnesus, and forming along with the neighboring island of Dhoko the Bay of Hydra. The length of the main axis of the island, which runs from southwest to northeast, is about eleven miles, and the area is about twenty-one square miles; but it is little better than a rocky and treeless ridge

with hardly a patch or two of arable soil. There was little exaggeration in the reply made by Antonios Kriezes to the queen of Greece: "The island produces prickly pears in abundance, splendid sea captains, and excellent prime ministers." The population in 1889 was 7,342.

HYDRANGEA, a popular flower much in request for the decoration of conservatories during the late summer season.

There are upward of thirty species, found chiefly in Japan, in the mountains of India and in North America, and many of them are familiar in gardens. *H. Hortensia* is the most useful for decoration, as the head of flowers lasts long in a fresh state, and by the aid of forcing can be had for a considerable period for the ornamentation of the greenhouse and conservatory. Their natural flowering season is toward the end of the summer, but they may be had earlier by means of forcing. *H. japonica* is another fine conservatory plant with foliage and habit much resembling the last-named, but this has flat corymbs of flowers, the central ones small and perfect, and the outer ones only enlarged and neuter. This also produces pink or blue flowers under the influence of different soils.

HYDRAULICS. See HYDROMECHANICS.

HYDROCEPHALUS, a term in medicine applied to two different forms of disease of the brain, both of which are attended with the effusion of fluid into its cavities. They are named respectively *Acute* and *Chronic Hydrocephalus*. They have different pathological associations, and have no necessary connection with each other.

Acute Hydrocephalus is the term still largely employed to describe the disease now known to physicians as tubercular cerebral meningitis, that is, inflammation of the membranes of the brain produced by the presence of tubercle. This disease is most common in children under ten years of age, but is by no means limited to that period of life, and may affect adults. The scrofulous or tubercular constitution is an important factor in this malady, which is admitted to be one of strongly hereditary tendency; yet unquestionably there are many instances in which no such taint can be traced. In numerous cases it is manifestly connected with bad hygienic conditions, with insufficient or improper feeding, or with over-exercise of the mental powers, all of which will doubtless more readily exert their influence where an inherited liability exists, and the same may be said regarding its occasional occurrence as one of the after consequences of certain of the diseases of childhood, especially measles and hooping-cough.

Acute hydrocephalus is usually described as passing through certain stages; but it must be observed, as regards at least its earlier manifestations, that, so far from being well defined, they are often exceedingly vague, and render this disease in an especial manner liable to escape detection for a length of time, or to be confounded with others to which at its commencement it bears an acknowledged resemblance, such, for instance, as typhoid fever or gastro-intestinal derangements. Nevertheless, there are certain typical features characterizing the disease in each of its stages which it is important to describe, as in many instances these present themselves with greater or less distinctness.

The premonitory symptoms of acute hydrocephalus are mostly such as relate to the general nutrition. A falling off in flesh and failure of strength are often observed for a considerable time before the characteristic phenomena of the disease appear. The patient, if a child, becomes listless and easily fatigued, loses appetite, and is restless at night. There is headache after exertion, and the temper often undergoes a marked

change, the child becoming unusually peevish and irritable. These symptoms may persist during many weeks; but on the other hand such premonitory indications may be entirely wanting, and the disease be developed to all appearance quite suddenly.

The onset is in most instances marked by the occurrence of vomiting, often severe, but sometimes only slight, and there is in general obstinate constipation. In not a few cases the first symptoms are convulsions, which, however, may in this early stage subside, and remain absent, or reappear at a later period. Headache is one of the most constant of the earlier symptoms, and is generally intense and accompanied with sharper paroxysms, which cause the patient to scream, with a peculiar and characteristic cry. There is great intolerance of light and sound, and general nervous sensitiveness. Fever is present to a greater or less extent, the temperature ranging from 100° to 103° Fahr.; yet the pulse is not quickened in proportion, being, on the contrary, rather slow, but exhibiting a tendency to irregularity, and liable to become rapid on slight exertion. The breathing, too, is somewhat irregular. Symptoms of this character, constituting the stage of excitement, continue for a period varying from one to two weeks, when they are succeeded by the stage of depression. There is now a marked change in the symptoms, which is apt to lead to the belief that a favorable turn has taken place. The patient becomes quieter and inclines to sleep, but it will be found, on careful watching, that this quietness is but a condition of apathy or partial stupor into which the child has sunk. The vomiting has now ceased, and there is less fever; the pulse is slower, and shows a still greater tendency to irregularity than before, while the breathing is of markedly unequal character, being rapid and shallow at one time, and long drawn out and sinking away at another. There is manifestly little suffering, although the peculiar cry may still be uttered, and the patient lies prostrate, occasionally rolling the head uneasily upon the pillow, or picking at the bedclothes or at his face with his fingers. He does not ask for food, but readily swallows what is offered. The countenance is pale, but is apt to flush up suddenly for a time. The eyes present important alterations, the pupils being dilated or unequal, and scarcely responding to light. There may be double vision, or partial or complete blindness. Squinting is common in this stage, and there may also be drooping of an eyelid, due to paralysis of the part, and one or more limbs may be likewise paralyzed.

To this succeeds the third or final stage, in which certain of the former symptoms recur, while others become intensified. There is generally a return of the fever, the temperature rising sometimes to a very high degree. The pulse becomes feeble, rapid, and exceedingly irregular, as is also the case with the breathing. Coma is profound, but yet the patient may still be got to swallow nourishment, though not so readily as before. Convulsions are apt to occur, while paralysis, more or less extensive, affects portions of the body or groups of muscles. The pupils are now widely dilated, and there is generally complete blindness and often deafness. In this condition the patient's strength undergoes rapid decline, and the body becomes markedly emaciated. Death takes place either suddenly, in a fit, or more gradually from exhaustion. Shortly before the fatal event, it is not uncommon for the patient, who, it may be for many days previously, lay in a state of profound stupor, to wake up, ask for food, and talk to those around. But the hopes which may thus be raised are quickly dispelled by the setting in of the symptoms of rapid sinking.

The duration of a case of acute hydrocephalus varies

somewhat, but in general death takes place within three weeks from the onset of the symptoms. The disease may be said to be almost invariably fatal, yet it must be admitted that cases presenting all the principal symptoms of acute hydrocephalus do occasionally recover, though such instances are undoubtedly very rare. Indeed, the condition of the brain in this disease, as revealed on *post-mortem* examination, renders its fatal character in no way surprising. The peculiar formation called tubercle is found deposited in the membranes of the brain, more particularly at its base. The irritation set up as a consequence of this is accompanied with the effusion of fluid into the arachnoid and ventricles, which by its pressure tends to produce softening and destruction of the brain substance, and hence to abolish its functions. In many instances the brain is found to be reduced to a state of complete disorganization.

Besides this condition of the brain, there exists in most cases deposition of tubercle elsewhere, as in the lungs and abdominal glands, and this may have given evidence of its presence even before the head symptoms had appeared. This is especially the case in adults, in whom acute hydrocephalus is more apt to arise as a complication in the course of pulmonary or other disease of tubercular origin than in the manner in which it occurs in children as above described.

With respect to treatment, little can be stated of an encouraging nature. Still it must be observed that much may be done in the way of prevention of this disease, and, in its earlier stages, even in the way of cure. It is most important in families where the history indicates a tuberculous or scrofulous tendency, and particularly where acute hydrocephalus has already occurred, that every effort should be used to fortify the system and avoid the causes already alluded to as favoring the development of the disease during that period in which children are liable to suffer from it. With this view wholesome food, warm clothing, cleanliness, regularity, and the avoidance of over-exertion, physical and mental, are of the utmost consequence.

Although there is but little that can be done when the disease has set in, yet the timely use of remedies may mitigate and even occasionally remove the symptoms. The severe headache may often be relieved by the application of one or two leeches to the temples, and by the frequent use of cold water or ice applied to the head. The treatment by blistering the scalp and administering mercury, formerly so much practiced, is now acknowledged to be of no real efficacy; and on the whole the maintenance of the patient's strength by light nourishment and the use of sedatives to compose the nervous system are the measures most likely to be attended with success. The bromide, with which may be combined the iodide of potassium, is the medicinal agent of most value for this purpose. Should convulsions occur, they are best treated by chloral or chloroform.

Chronic Hydrocephalus is a different form of disease from that last described, both as regards its pathology and its effects. It consists in an effusion of fluid into the serous cavities (arachnoid and ventricles) of the brain, not preceded by tuberculous deposit or acute inflammation, but apparently depending on chronic inflammatory changes affecting the membranes, and is to be regarded as a kind of dropsy. The disease is frequently congenital, and its presence in the foetus is apt to be a source of difficulty in parturition. It is, however, more commonly developed in the course of the first six months of life; but it occasionally arises in older children, or even in adults, as in the well-known instance of Dean Swift, who died from this disease.

Chronic hydrocephalus affects mostly children who

bear evidence of a scrofulous, rickety, or otherwise delicate constitution. The chief symptoms observed are the gradual increase in size of the upper part of the head out of all proportion to the face or the rest of the body. Occurring at an age when as yet the separate bones constituting the skull have not become welded, this enlargement may go on to a very considerable extent in all directions, but chiefly in the transverse and antero-posterior diameters, the spaces between the bones becoming more and more expanded, though ultimately, should the child survive, ossification takes place. In a well-marked case the deformity is very striking. The upper part of the forehead projects abnormally, and the orbital plates of the frontal bone being inclined forward give a downward direction to the eyes, which have also peculiar rolling movements. The face is small, and this, with the enlarged head, gives a remarkably aged expression to the child. There is generally defective development in other respects, the body being ill nourished, the bones thin, the hair scanty and fine, and the teeth carious or absent.

As illustrating the extent to which this disease may proceed, it may be mentioned that the average circumference of the adult head is about twenty-two inches, while in the child it is of course considerably less. In chronic hydrocephalus the head of an infant three months old has been known to measure twenty-nine inches; and in the well-known case of the man Cardinal, who died in Guy's Hospital, the head measured thirty-three inches. In the museum of the faculty of medicine in Paris there is a hydrocephalic skull measuring thirty-nine inches. In aggravated cases the head cannot be supported by the neck, and the patient has to keep in the recumbent posture. The expansibility of the skull prevents destructive pressure on the brain, yet this organ is materially affected by the presence of the fluid. The cerebral ventricles are widely distended, and the convolutions flattened, while occasionally the fluid escapes into the cavity of the cranium, which it fills, pressing down the brain to the base of the skull. As a consequence of such changes, the functions of the brain are interfered with, and in general the mental condition of the patient is impaired to a greater or less extent. The child is dull and listless, irritable, and sometimes imbecile. The special senses become affected as the disease advances, especially vision, and sight is often lost, as is also hearing. Toward the close paralysis is apt to occur. Hydrocephalic children rarely live long, generally dying from the malady in a few years, or succumbing to some of the disorders of childhood, which they are little able to resist. Nevertheless there have been many instances of persons with this disease reaching maturity, and even living to old age. It must also be borne in mind that there are grades of this affection, and that children may present many of the symptoms of it in a comparatively slight degree, and yet recover, the head ceasing to expand, and becoming firmly ossified.

Various methods of treatment have been employed in this disease, but the results are seldom satisfactory. Compression of the head by bandages, and the administration of mercury with the view of promoting absorption of the fluid, are now little resorted to. Tapping the fluid from time to time through one of the spaces between the bones, drawing off a little, and thereafter employing gentle pressure, has been tried, but seldom with permanent benefit. On the whole, the plan of treatment which aims at maintaining the patient's nutrition by appropriate food and tonics is at once the most rational and successful, provided it be resorted to in time to admit of the arrest of the progress of the symptoms.

HYDROGEN (from ὕδωρ, water, and γεννάω,

to generate) is a chemical element which in the free state occurs in volcanic gases, but exists for the most part in combination with oxygen as water. As its elemental characteristics and the chief compounds of hydrogen, have already been described in the article CHEMISTRY, it is here only necessary to refer to the liquefaction of gaseous hydrogen.

At the close of 1877 and in the beginning of 1878, not only hydrogen, but all the so-called permanent gases, were reduced to the liquid state, an achievement the more remarkable as it was the result of the simultaneous but entirely independent labors of two distinguished physicists, M. Cailletet of Châtillon-sur-Seine and M. Pictet of Geneva.

HYDROMECHANICS. The word *Hydromechanics* is derived from the Greek ὕδρο-μηχανικά, meaning the mechanics of water and fluids in general. The science is divided into three branches:—*Hydrostatics*, which deals with the equilibrium of fluids; *Hydrodynamics*, which deals with the mathematical theory of the motion of fluids, neglecting the viscosity; and *Hydraulics*, in which the motion of water in pipes and canals is considered, and hydrodynamical questions of practical application are investigated. Of hydrodynamics we shall only speak incidentally here, as the subject is too purely technical to be understood, except by the use of mathematical demonstrations, too long to be included in a work of this scope.

The science of hydromechanics was cultivated with less success among the ancients than any other branch of mechanical philosophy. When the human mind had made considerable progress in the other departments of physical science, the doctrine of fluids had not begun to occupy the attention of philosophers; and, if we except a few propositions on the pressure and equilibrium of water, hydromechanics must be regarded as a modern science, which owes its existence and improvement to those great men who adorned the seventeenth and eighteenth centuries.

Those general principles of hydrostatics which are to this day employed as the foundation of that part of the science were first given by Archimedes about 250 B.C., and were afterward applied to experiments by Marinus Ghetaldus in his *Promotus Archimedes* (1603). Archimedes maintained that each particle of a fluid mass, when in equilibrium, is equally pressed in every direction; and he inquired into the conditions according to which a solid body floating in a fluid should assume and preserve a position of equilibrium. We are also indebted to him for that ingenious hydrostatic process by which the purity of the precious metals can be ascertained, and for the screw engine which goes by his name.

In the Greek school at Alexandria, which flourished under the auspices of the Ptolemies, the first attempts were made at the construction of hydraulic machinery. About 120 B.C. the fountain of compression, the siphon, and the forcing pump were invented by Ctesibius and Hero; and, though these machines operated by the pressure of the air, yet their inventors had no distinct notions of the preliminary branches of pneumatical science. The siphon is a simple instrument; but the forcing pump is a complicated and abstruse invention, which could scarcely have been expected in the infancy of hydraulics. It was probably suggested to Ctesibius by the *Egyptian Wheel* or *Noria*, which was common at that time, and which was a kind of chain pump, consisting of a number of earthen pots carried round by a wheel. In some of these machines the pots have a valve in the bottom which enables them to descend without much resistance, and diminishes greatly the load upon the wheel; and, if we suppose that this valve was introduced so early as the time of Ctesibius, it is not difficult

to perceive how such a machine might have led that philosopher to the invention of the forcing pump.

Notwithstanding these inventions of the Alexandrian school, its attention does not seem to have been directed to the motion of fluids. The first attempt to investigate this subject was made by Sextus Julius Frontinus, inspector of the public fountains at Rome in the reigns of Nerva and Trajan; and we may justly suppose that his work, entitled *De Aqueductibus Urbis Romæ Commentarius*, contains all the hydraulic knowledge of the ancients. After describing the nine great Roman aqueducts, to which he himself added five more, and mentioning the dates of their erection, he considers the methods which were at that time employed for ascertaining the quantity of water discharged from ajutages, and the mode of distributing the waters of an aqueduct or a fountain. He justly remarks that the flow of water from an orifice depended not only on the magnitude of the orifice itself, but also on the height of the water in the reservoir; and that a pipe employed to carry off a portion of water from an aqueduct should, as circumstances required, have a position more or less inclined to the original direction of the current. But as he was unacquainted with the true law of the velocities of running water as depending upon the depth of the orifice, we can scarcely be surprised at the want of precision which appears in his results.

It has generally been supposed that the Romans were ignorant of the art of conducting and raising water by means of pipes; but it can scarcely be doubted, from the statement of Pliny and other authors, not only that they were acquainted with the hydrostatical principle, but that they actually used leaden pipes for the purpose. Pliny asserts that water will always rise to the height of its source, and he also adds that, in order to raise water up to an eminence, leaden pipes must be employed.

Castelli and Torricelli, two of the disciples of Galileo, applied the discoveries of their master to the science of hydrodynamics. In 1628 Castelli published a small work, *Della Misura dell' acque correnti*, in which he gave a very satisfactory explanation of several phenomena in the motion of fluids in rivers and canals. But he committed a great paralogism in supposing the velocity of the water proportional to the depth of the orifice below the surface of the vessel. Torricelli, observing that in a jet where the water rushed through a small ajutage it rose to nearly the same height with the reservoir from which it was supplied, imagined that it ought to move with the same velocity as if it had fallen through that height by the force of gravity. And hence he deduced this beautiful and important proposition, that the velocities of fluids are as the square root of the head, allowing for the resistance of the air and the friction of the orifice. This theorem was published in 1643, at the end of his treatise *De Motu gravium Projectorum*. It was afterward confirmed by the experiments of Raphael Magiotti on the quantities of water discharged from different ajutages under different pressures; and, though it is true only in small orifices, it gave a new turn to the science of hydraulics.

After the death of the celebrated Pascal, who discovered the pressure of the atmosphere, a treatise on the equilibrium of fluids was found among his manuscripts, and was given to the public in 1663. In the hands of Pascal hydrostatics assumed the dignity of a science. The laws of the equilibrium of fluids were demonstrated in the most perspicuous and simple manner, and amply confirmed by experiments. The discovery of Torricelli, it may be supposed, would have incited Pascal to the study of hydraulics. But, as he has not treated this subject in the work mentioned, it was probably composed before that discovery had been made public.

The theorem of Torricelli was employed by many succeeding writers, but particularly by the celebrated Mariotte, whose labors in this department of physics deserve to be recorded. His *Traité du Mouvement des Eaux*, which was published after his death in the year 1686, is founded on a great variety of well-conducted experiments on the motion of fluids, performed at Versailles and Chantilly. In the discussion of some points he has committed considerable mistakes. Others he has treated very superficially, and in none of his experiments does he seem to have attended to the diminution of efflux arising from the contraction of the fluid vein, when the orifice is merely a perforation in a thin plate; but he appears to have been the first who attempted to ascribe the discrepancy between theory and experiment to the retardation of the water's velocity arising from friction. His contemporary Guglielmini, who was inspector of the rivers and canals in the Milanese, had ascribed this diminution of velocity in rivers to transverse motions arising from inequalities in their bottom. But as Mariotte observed similar obstructions even in glass pipes, where no transverse currents could exist, the cause assigned by Guglielmini seemed destitute of foundation. The French philosopher, therefore, regarded these obstructions as the effects of friction. He supposes that the filaments of water which graze along the sides of the pipe lose a portion of their velocity; that the contiguous filaments, having on this account a greater velocity, rub upon the former, and suffer a diminution of their celerity; and that the other filaments are affected with similar retardations proportional to their distance from the axis of the pipe. In this way the medium velocity of the current may be diminished, and consequently the quantity of water discharged in a given time must, from the effects of friction, be considerably less than that which is computed from theory. Guglielmini was the first who attended to the motion of water in rivers and open canals (*La Misura dell' acque correnti*). Embracing the theorem of Torricelli, which had been confirmed by repeated experiments, Guglielmini concluded that each particle in the perpendicular section of a current has a tendency to move with the same velocity as if it issued from an orifice at the same depth from the surface. The consequences deducible from this theory of running waters are in every respect repugnant to experience, and it is really surprising that it should have been so hastily adopted by succeeding writers. Guglielmini himself was sufficiently sensible that his parabolic theory was contrary to fact, and endeavored to reconcile them by supposing the motion of rivers to be obstructed by transverse currents arising from irregularities in their bed. The solution of this difficulty, as given by Mariotte, was more satisfactory, and was afterward adopted by Guglielmini, who maintained also that the viscosity of water had a considerable share in retarding its motion.

The effects of friction and viscosity in diminishing the velocity of running water were noticed in the *Principia* of Sir Isaac Newton, who threw much light upon several branches of hydromechanics. At a time when the Cartesian system of vortices universally prevailed, this great man found it necessary to investigate that absurd hypothesis, and in the course of his investigations he showed that the velocity of any stratum of the vortex is an arithmetical mean between the velocities of the strata which inclose it; and from this it evidently follows that the velocity of a filament of water moving in a pipe is an arithmetical mean between the velocities of the filaments which surround it. Taking advantage of these results, it was afterward shown by Pitot that the retardations arising from friction are inversely as

the diameters of the pipes in which the fluid moves. The attention of Newton was also directed to the discharge of water from orifices in the bottom of vessels. He supposed a cylindrical vessel full of water to be perforated in its bottom with a small hole by which the water escaped, and the vessel to be supplied with water in such a manner that it always remained full at the same height. He then supposed this cylindrical column of water to be divided into two parts—the first, which he calls the “cataract,” being an hyperboloid generated by the revolution of an hyperbola of the fifth degree around the axis of the cylinder which should pass through the orifice, and the second the remainder of the water in the cylindrical vessel. He considered the horizontal strata of this hyperboloid as always in motion, while the remainder of the water was in a state of rest, and imagined that there was a kind of cataract in the middle of the fluid. When the results of this theory were compared with the quantity of water actually discharged, Newton concluded that the velocity with which the water issued from the orifice was equal to that which a falling body would receive by descending through half the height of water in the reservoir. This conclusion, however, is absolutely irreconcilable with the known fact that jets of water rise nearly to the same height as their reservoirs, and Newton seems to have been aware of this objection. In the second edition of his *Principia* accordingly, which appeared in 1714, he reconsidered his theory. He had discovered a contraction in the vein of fluid (*vena contracta*) which issued from the orifice, and found that, at the distance of about a diameter of the aperture, the section of the vein was contracted in the subduplicate ratio of two to one. He regarded, therefore, the section of the contracted vein as the true orifice from which the discharge of water ought to be deduced, and the velocity of the effluent water as due to the whole height of water in the reservoir; and by this means his theory became more conformable to the results of experience. This theory, however, is still liable to serious objections. The formation of a cataract is by no means agreeable to the laws of hydrostatics; for when a vessel is emptied by the efflux of water through an orifice in its bottom, all the particles of the fluid direct themselves toward this orifice, and therefore no part of it can be considered as in a state of repose.

The subject of the oscillation of waves, one of the most difficult in the science of hydrodynamics, was first investigated by Newton. In the forty-fourth proposition of the second book of his *Principia*, he has furnished us with a method of ascertaining the velocity of the waves of the sea, by observing the time in which they rise and fall. If the two vertical branches of a siphon, which communicate by means of a horizontal branch, are filled with a fluid of known density, the two fluid columns, when in a state of rest, will be in equilibrium and their surfaces horizontal. But if the one column is raised above the level of the other, and left to itself, it will descend below that level, and raise the other column above it, and, after a few oscillations, they will return to a state of repose. Newton occupied himself in determining the duration of these oscillations, or the length of a pendulum isochronous to their duration; and he found, by a simple process of reasoning, that, allowing for the effects of friction, the length of a synchronous pendulum is equal to one-half of the length of the siphon, that is, of the two vertical branches and the horizontal one, and hence he deduced the isochronism of these oscillations. From this Newton concluded that the velocity of waves formed on the surface of water, either by the wind or by a body thrown into it, was in the subduplicate ratio of their size. When their

velocity, therefore, is measured, which can be easily done, the size of the waves will be determined by means of a pendulum, which oscillates in the time that a wave takes to rise and fall.

Such was the state of hydrodynamics in 1738, when Daniel Bernoulli published his *Hydrodynamica, sive de Viribus et Motibus Fluidorum Commentarii*. The germ of Daniel Bernoulli's theory was first published in his memoir entitled *Theoria Nova de Motu Aquarum per Canales quocunque fluentes*, which he had communicated to the Academy of St. Petersburg as early as 1726. His theory of the motion of fluids was founded on two suppositions, which appeared to him conformable to experience. He supposed that the surface of a fluid, contained in a vessel which is emptying itself by an orifice, remains always horizontal; and, if the fluid mass is conceived to be divided into an infinite number of horizontal strata of the same bulk, that these strata remain contiguous to each other, and that all their points descend vertically, with velocities inversely proportional to their breadth, or to the horizontal sections of the reservoir. In order to determine the motion of each stratum, he employed the principle of the *conservatio virium vivarum*, and obtained very elegant solutions. In the opinion of the Abbé Bossut, his work was one of the finest productions of mathematical genius. The uncertainty of the principle employed by Daniel Bernoulli, which has never been demonstrated in a general manner, deprived his results of that confidence which they would otherwise have deserved, and rendered it desirable to have a theory more certain, and depending solely on the fundamental laws of mechanics. Maclaurin and John Bernoulli, who were of this opinion, resolved the problem by more direct methods, the one in his *Fluxions*, published in 1742, and the other in his *Hydraulica nunc primum detecta, et demonstrata directe ex fundamentis pure mechanicis*, which forms the fourth volume of his works. The method employed by Maclaurin has been thought not sufficiently rigorous; and that of John Bernoulli is, in the opinion of Lagrange, defective in perspicuity and precision.

The theory of Daniel Bernoulli was opposed also by the celebrated D'Alembert. When generalizing James Bernoulli's theory of pendulums he discovered a principle of dynamics so simple and general that it reduced the laws of the motions of bodies to that of their equilibrium. He applied this principle to the motion of fluids, and gave a specimen of its application at the end of his *Dynamics* in 1743. It was more fully developed in his *Traité des Fluides*, which was published in 1744, where he has resolved, in the most simple and elegant manner, all the problems which relate to the equilibrium and motion of fluids. He makes use of the very same suppositions as Daniel Bernoulli, though his calculus is established in a very different manner. He considers, at every instant, the actual motion of a stratum as composed of a motion which it had in the preceding instant and of a motion which it has lost. The laws of equilibrium between the motions lost furnish him with equations which represent the motion of the fluid. Although the science of hydrodynamics had then made considerable progress, yet it was chiefly founded on hypothesis. It remained a desideratum to express by equations the motion of a particle of the fluid in any assigned direction. These equations were found by D'Alembert from two principles—that a rectangular canal, taken in a mass of fluid in equilibrium, is itself in equilibrium; and that a portion of the fluid, in passing from one place to another, preserves the same volume when the fluid is incompressible, or dilates itself according to a given law when the fluid is elastic. His very ingenious method was published in 1752, in his *Essai sur la Resistance des Fluides*. It

was brought to perfection in his *Opuscles Mathématiques*, and was adopted by Euler.

Before the time of D'Alembert, it was the great object of philosophers to submit the motion of fluids to general formulæ, independent of all hypothesis. Their attempts, however, were altogether fruitless; for the method of fluxions, which produced such important changes in the physical sciences, was but a feeble auxiliary in the science of hydraulics. For the resolution of the questions concerning the motion of fluids, we are indebted to the method of partial differences, a new calculus, with which Euler enriched the sciences. This great discovery was first applied to the motion of water by D'Alembert, and enabled both him and Euler to represent the theory of fluids in formulæ restricted by no particular hypothesis.

The most successful laborer in the science of hydrodynamics was the Chevalier Dubuat, engineer in ordinary to the king of France. Following in the steps of the Abbé Bossut (*Nouvelles expériences sur la résistance des fluides*, 1777), he prosecuted the inquiries of that philosopher with uncommon ingenuity; and in the year 1786 he published, in two volumes, his *Principes d'Hydraulique*, which contains a satisfactory theory of the motion of fluids, founded solely upon experiments. Dubuat considered that if water were a perfect fluid, and the channels in which it flowed infinitely smooth, its motion would be continually accelerated, like that of bodies descending in an inclined plane. But as the motion of rivers is not continually accelerated, and soon arrives at a state of uniformity, it is evident that the viscosity of the water, and the friction of the channel in which it descends, must equal the accelerating force. Dubuat therefore assumes it as a proposition of fundamental importance that, when water flows in any channel or bed, the accelerating force which obliges it to move is equal to the sum of all the resistances which it meets with, whether they arise from its own viscosity or from the friction of its bed. This principle was employed by Dubuat in the first edition of his work, which appeared in 1779, but the theory contained in that edition was founded on the experiments of others. He soon saw, however, that a theory so new, and leading to results so different from the ordinary theory, should be founded on new experiments more direct than the former, and he was employed in the performance of these from 1780 to 1783. The experiments of Bossut having been made only on pipes of a moderate declivity, Dubuat found it necessary to supply this defect. He used declivities of every kind, and made his experiments upon channels from a line and a half in diameter to seven or eight square toises.

The theory of running water was greatly advanced by the researches of Prony. From a collection of the best experiments by Couplet, Bossut, and Dubuat he selected eighty-two (fifty-one on the velocity of water in conduit pipes, and thirty-one on its velocity in open canals); and, discussing these on physical and mechanical principles, he succeeded in drawing up general formulæ, which afford a simple expression for the velocity of running water.

Eytelwein of Berlin published, in 1801, a valuable compendium of Hydraulics, entitled *Handbuch der Mechanik und der Hydraulik*, which contains an account of many new and valuable experiments made by himself. He investigates the subject of the discharge of water by compound pipes, the motions of jets, and their impulses against plane and oblique surfaces; and he shows theoretically that a water wheel will have its effect a maximum when its circumference moves with half the velocity of the stream.

A series of interesting hydraulic experiments was

made at Rome in 1809 by Mallet and Vici. They found that a pipe whose gauge was five ounces French measure furnished one-seventh more water than five pipes of one ounce, an effect arising from the velocity being diminished by friction in the ratio of the perimeters of the orifices as compared with their areas.

Hachette, in the year 1816, presented to the National Institute a memoir containing the results of experiments which he had made on the spouting of fluids, and the discharge of vessels. The objects he had in view were to measure the contracted part of a fluid vein, to examine the phenomena attendant on additional tubes, and to investigate and describe the figure of the fluid vein, and the results which take place when different forms of orifices are employed. Hachette showed in the second part of his memoir that greater or lesser volumes of water will be discharged in the same time through tubes of different figures, the apertures in all having the same dimensions. He also gave several remarkable results respecting other fluids issuing out of orifices into air or a vacuum.

Several very interesting experiments on the propagation of waves have been made by the brothers Weber, and by Bidone. Mr. John Scott Russell performed a number of experiments on waves, which are described in the *Edinburgh Transactions*, vol. xiv., and in the *British Association Report* for 1837. The mathematical theory has been worked out by Green, Stokes, Rankine, and other mathematicians, but still offers an interesting field for the investigator. Stokes' Report of the British Association for 1846 on Recent Researches in Hydrodynamics gives an account of the subject as it existed at that date.

In 1826 Bidone, besides his experiments on waves, made a series on the velocity of running water at the hydraulic establishment of the university of Turin, and he published an account of them in 1829. After giving a description of his apparatus and method of experimenting, he gives the figures obtained from fluid veins, sections of which were taken at different distances from the orifice.

In the year 1827 Poncelet published a *Mémoire sur les Roues Hydrauliques à Aubes Courbes*, containing his experiments on the undershot wheel with curved palletes, which he had invented in the year 1824. The best undershot previous to the introduction of the Poncelet wheel never developed more than 0.25 of the work of the water, whereas this utilized 0.60 of that work, which is nearly equivalent to the maximum effect of the breast wheel. The principle on which the Poncelet wheel acts, and that which makes it utilize so much of the work of the water, is that the water is received by the curved floats without any shock, and is discharged finally with a small velocity. This undershot wheel is much used in France.

Previous to the year 1827, the wheels required in the mills and manufactories of Germany and France were generally those which worked with the axis horizontal, or the tub and spoon wheels with the axis vertical; but in that year a young mechanic, named Fourneyron, introduced a wheel working with the axis vertical, yet wholly different from the latter kind. Fourneyron showed that in existing wheels with a vertical axis the water left the wheel with considerable velocity in the direction of the motion of the wheel, and thus carried away and wasted much of the energy of the fall. By the introduction of a series of fixed guide blades, which gave the water initially a backward velocity of rotation, the water left the wheel with a much smaller velocity of discharge. He thus invented the first complete turbine, a kind of water motor which has largely superseded the more cumbrous water wheels previously in use. Shortly

after the invention was made public, Fourneyron was awarded the prize of 6,000 francs which was offered by the Society for the Encouragement of National Industry.

The most extensive experiments on the discharge of water from orifices are those made under the direction of the French Government by Poncelet and Lesbros (*Experiences Hydrauliques*, Paris, 1851). Boileau (*Traité de la mesure des eaux courantes*) has discussed these results and added experiments of his own. Bornemann has reexamined all these results with great care, and has been able to express in formulæ the variation of the coefficients of discharge in different conditions (*Civilingenieur*, 1880). Very valuable experiments leading to a modification of the usual formula for the discharge over weirs were made by Mr. J. B. Francis (*Lowell Hydraulic Experiments*, Boston, Mass., 1855). Wiesbach also has made many experimental investigations of the discharge of fluids.

The friction of water investigated originally by Coulomb at slow speeds has been measured for higher speeds by Mr. W. Froude, whose researches have very great value in the theory of ship resistance.

The flow of air and steam from orifices has been measured by many experimenters from Young to Saint Venant. Mr. Napier in some interesting experiments first pointed out that when the ratio of the pressures on the two sides of an orifice exceeded a certain limit the measured discharge was very different from that calculated by the accepted formulæ. Since then numerous experiments have been made, and the theory of the flow of elastic fluids has been discussed in numerous memoirs. The valuable investigations of Flegner deserve special mention.

A most valuable investigation of the flow of water in pipes and channels has been carried out with exceptional accuracy and on a very large scale by the late M. Darcy, and continued by his successor, the late M. Bazin, at the expense of the French Government (*Recherches Hydrauliques*, Paris, 1866). The measurement of the flow in rivers has been extensively carried out, especially by German engineers. Harlacher's *Beiträge zur Hydrographie des Königreiches Böhmen* contains exceedingly valuable measurements of this kind, and a comparison of the experimental results with all the formulæ of flow which have been proposed. Messrs. Humphreys and Abbott's gaugings of the Mississippi for the United States Government, Mr. Gordon's gaugings of the Irrawaddy, and Captain Cunningham's experiments on the Ganges Canal may be referred to as having materially advanced hydraulic science.

The first adequate theory of turbines is that of Poncelet in the *Comptes Rendus de l'Académie de Paris*, 1838. Redtenbacher's *Theorie und Bau der Turbinen und Ventilatoren* (Mannheim, 1844) is the first complete treatise on the subject. Girard's turbine, which was of an entirely new type, was discussed in *Le Génie industriel*, 1856-1857, and lately by Fink (*Civilingenieur*, 1880). Important experiments on turbines were made by Francis (*Lowell Hydraulic Experiments*, Boston, Mass., 1855).

Hydromechanics is the science of the equilibrium and motion of fluids, both elastic and non-elastic. A fluid is defined to be a substance which yields continually to the slightest tangential stress; and, consequently, when the fluid has come to rest, the stress across any surface in the fluid must be normal to the surface.

The stress considered in hydromechanics is always a pressure, as fluids are in general capable of sustaining only a slight tension without disruption (see CAPILLARY ACTION). The intensity of the pressure is measured, as in the subject of the elasticity, by the number of units of force per unit of area.

The pressure across any surface being normal to the surface, it follows from the general equations of internal stress (see ELASTICITY) that at a point the pressure is the same in all directions about the point.

If forces act throughout the fluid so that the pressure varies from one point to another, we must suppose the tetrahedron taken indefinitely small, and then the impressed forces, depending on the volume, may be neglected in comparison with the forces acting on the faces, which depend on the surface of the tetrahedron.

When fluids such as exist in nature are in motion, the stresses across any surfaces are no longer normal, but tangential stresses are called into play, the intensities of which depend upon the relative motion of the parts of the fluid; those tangential stresses are said to be due to the viscosity of the fluid.

The difference between a solid and a fluid is that in a solid the tangential stress must exceed a certain amount before permanent shearing takes place, otherwise the stress being removed the solid regains its shape; in a fluid the slightest tangential stress produces a permanent deformation, and if continued long enough will cause a complete change of form, however great the viscosity of the fluid may be. But little progress has been made in the theory of the motion of viscous fluids, those cases which have been worked out mostly falling under the head of the practical subject of hydraulics. In the theoretical subject of hydrodynamics the motion of the so-called *perfect* fluids only is considered—fluids in which no viscosity is supposed to exist, and in which therefore the pressure at a point is the same in all directions.

Fluids are divided into two classes, incompressible fluids called liquids, and compressible fluids called gases. The so-called incompressible fluids are in reality compressible, but the compressibility being small is neglected in ordinary problems.

The *compression* of a substance is defined to be the ratio of the diminution of the volume to the original volume; and the *compressibility* is defined to be the ratio of the compression to the pressure producing it. The *elasticity* or *resilience of volume* is the ratio of the pressure to the compression produced, and is therefore the reciprocal of the compressibility. Fluids, from the definition, possess only elasticity of volume; an elastic solid possesses in addition an elasticity of figure, called also the *rigidity*.

The elasticity of water is also proved to exist, and can be determined from the velocity of sound in water; for instance, in water of density unity, the velocity is the square root of the elasticity, and therefore 144,000 centimeters per second, which agrees closely with the velocity determined by experiment.

Compressible fluids or gases are assumed to obey the two gaseous laws.

The first gaseous law, discovered by Boyle, and generally called Boyle's law, asserts that the pressure of a given quantity of a gas at a given temperature varies inversely as the volume, or directly as the density.

The *density* is defined to be the number of units of mass in the unit of volume, and the *specific volume* is the volume of the unit of mass. Hence Boyle's law asserts that the pressure of a gas at a given temperature varies as the density, or inversely as the specific volume.

Dalton generalized Boyle's law for a mixture of gases by enunciating the law that the pressure of a mixture of gases is the sum of the separate pressure each gas would have if it existed alone in the containing vessel.

If we suppose all the gases the same, we are led to Boyle's law, since, if a gram of air in a centimeter cube produces a certain pressure, then two grammes will produce double the pressure, three grammes treble the pressure, and so on; hence the pressure varies as the

density. This method of exhibiting Boyle's law is due to Rankine (Maxwell, *Heat*, p. 27).

The second gaseous law was discovered by Charles, but it generally goes by Gay-Lussac's name. It asserts that under constant pressure the volume of a given quantity of every gas increases by about $\frac{1}{273}$ of its volume at 0° C. for a rise of temperature of 1° C.

PART I.—HYDROSTATICS.

Hydrostatics is the science of the equilibrium of fluids. When a fluid has come to rest there can be no tangential stress, and consequently the stress across any surface is normal to the surface, and therefore the same in all directions about a point.

The pressure is the same at all points in a horizontal plane of a liquid at rest under gravity.

For, taking any two points in the same horizontal plane, and joining them, and describing about the joining line as axis an indefinitely thin cylinder, then, since the weight and the pressures on the sides of the cylinder are normal to the axis of the cylinder, resolving parallel to the axis of the cylinder, the pressures on the ends must be equal for equilibrium, and must therefore be of equal intensity.

It follows that the free surface must be a horizontal plane, supposing the pressure uniform over it, and gravity to act in parallel vertical lines.

That the free surface is a plane is verified experimentally by the fact that objects are seen by reflection at the surface undisturbed as in a plane mirror; and that it is a horizontal plane is verified by the fact that a plumb line and its image by reflection at the surface always appear in the same straight line.

The pressure at any point of a liquid at rest under gravity is proportional to the depth.

The pressure at any point of the base being the same and due to the depth below the free surface, whatever be the shape of the sides of the vessel, it follows that the pressure on the base is equal to the weight of the liquid contained in an imaginary cylinder, traced out by vertical lines round the base reaching to the surface.

Archimedes' Principle.—The resultant pressure of a fluid on a body immersed in it acts vertically upward through the center of gravity, and is equal to the weight of the displaced liquid.

For, suppose the body removed and its place filled up with fluid as it would be at rest, and imagine for clearness this fluid solidified. The fluid pressures which act upon this solidified fluid are the same as before, and since the fluid is in equilibrium under its own weight and the fluid pressures, the resultant of the fluid pressures must be a single vertical force equal to the weight of the displaced liquid, and acting upward through the center of gravity of the displaced liquid.

To find the resultant vertical and horizontal pressures on one side of a portion of a surface immersed in fluid at rest under gravity:

The resultant vertical pressure is the weight of the superincumbent fluid contained by vertical lines drawn around the bounding curve of the surface to the free surface. If, however, the free surface does not extend over the surface, we must suppose it made to do so by filling up the empty space with fluid. The line of action of the resultant vertical pressure passes through the center of gravity of this superincumbent fluid.

The resultant horizontal pressure in any direction is equal to the resultant pressure on the plane area traced out on a plane perpendicular to the given horizontal direction by horizontal lines drawn through the bounding line of the surface in the given direction; this plane area is called the orthogonal projection of the surface on a plane perpendicular to the given direction. For, re-

solving in the given direction the weight of the inclosed liquid and the pressures on the cylindrical surface traced out by the horizontal lines acting in a direction at right angles, the horizontal components of the pressures on the ends balance, which proves the proposition. The line of action of this horizontal pressure passes through the center of pressure of the plane area.

If a plane area be immersed in homogeneous liquid at rest under gravity, the resultant force acting on one side of the area will be the product of the area and the pressure at the center of gravity of the area.

Center of Pressure.—When a plane area is exposed to fluid pressure on one side, the resultant force experienced by the area is a single force perpendicular to the area, the sum of all the separate pressures, and acts through a definite point called the *center of pressure*.

PART II.—HYDRODYNAMICS.

In considering the motion of fluids we suppose them non-viscous, so that whatever be the state of motion, the stress across any section is normal to the section, and therefore the stress is a pressure and the same in all directions about a point, as in Hydrostatics.

Two methods are employed in hydrodynamics, called the Eulerian and Lagrangian, although both are due to Euler; in the Eulerian we fix our attention on particular points of space, and observe the changes of pressure, density, and velocity which take place there, and in the Lagrangian we follow a particle of fluid and observe its changes. The first may be called the statistical and the second the historical method, according to Prof. J. C. Maxwell. The Eulerian method is generally employed except where the fluid has a moving boundary.

PART III.—HYDRAULICS.

1. *Properties of Fluids.*—The fluids to which the laws of practical hydraulics relate are substances the parts of which possess very great mobility, or which offer a very small resistance to distortion independently of inertia. Under the general heading Hydromechanics a fluid is defined to be a substance which yields continually to the slightest tangential stress, and hence in a fluid at rest there can be no tangential stress. But, further, in fluids such as water, air, steam, etc., the tangential stresses that are called into action between contiguous portions during distortion or change of figure are always small compared with the weight, inertia, pressure, etc., which produce the visible motions it is the object of hydraulics to estimate. On the other hand, while a fluid passes easily from one form to another, it opposes considerable resistance to change of volume.

It is easily deduced from the absence or smallness of the tangential stress that contiguous portions of fluid act on each other with a pressure which is exactly or very nearly normal to the interface which separates them. The stress must be a pressure, not a tension, or the parts would separate. Further, at any point in a fluid the pressure in all directions must be the same; or, in other words, the pressure on any small element of surface is independent of the orientation of the surface.

2. Fluids are divided into liquids, or incompressible fluids, and gases, or compressible fluids. * Very great changes of pressure change the volume of liquids only by a small amount, and if the pressure on them is reduced to zero they do not sensibly dilate. In gases or compressible fluids the volume alters sensibly for small changes of pressure, and if the pressure is indefinitely diminished they dilate without limit.

In ordinary Hydraulics, liquids are treated as absolutely incompressible. In dealing with gases the changes

of volume which accompany changes of pressure must be taken into account.

3. Viscous fluids are those in which change of form under a continued stress proceeds gradually and increases indefinitely. A very viscous fluid opposes great resistance to change of form in a short time, and yet may be deformed considerably by a small stress acting for a long period. A block of pitch is more easily splintered than indented by a hammer, but under the action of the mere weight of its parts acting for a long enough time it flattens out and flows like a liquid.

All actual fluids are viscous. They oppose a resistance to the relative motion of their parts. This resistance diminishes with the velocity of the relative motion, and becomes zero in a fluid the parts of which are relatively at rest. When the relative motion of different parts of a fluid is small, the viscosity may be neglected without introducing important errors. On the other hand, where there is considerable relative motion, the viscosity may be expected to have an influence too great to be neglected.

4. When a fluid flows in a very regular manner, as for instance when it flows in a capillary tube, the velocities vary gradually at any moment from one point of the fluid to a neighboring point. The layer adjacent to the sides of the tube adheres to it and is at rest. The layers more interior than this slide on each other. But the resistance developed by these regular movements is very small. If in large pipes and open channels there were a similar regularity of movement, the neighboring filaments would acquire, especially near the sides, very great relative velocities. Boussinesq has shown that the central filament in a semicircular canal of one meter radius, and inclined at a slope of only 0.0001, would have a velocity of 187 meters per second, the layer next the boundary remaining at rest. But before such a difference of velocity can arise, the motion of the fluid becomes much more complicated. Volumes of fluid are detached continually from the boundaries, and, revolving, form eddies traversing the fluid in all directions, and sliding with finite relative velocities against those surrounding them. These slidings develop resistances, incomparably greater than the viscous resistance due to movements varying continuously from point to point. The movements which produce the phenomena commonly ascribed to fluid friction must be regarded as rapidly or even suddenly varying from one point to another. The internal resistances to the motion of the fluid do not depend on the general velocities of translation at different points of the fluid (or what M. Boussinesq terms the mean local velocities), but rather on the intensity at each point of the eddying agitation. The problems of hydraulics are therefore much more complicated than problems in which a regular motion of the fluid is assumed, hindered by the viscosity of the fluid.

5. *Density of Water.*—Water at ordinary temperature and pressure contains 62.4 pounds per cubic foot, or 1,000 kilogrammes per cubic meter, the standard used being always distilled and free as possible from extraneous matter. River and spring water is not sensibly denser than pure water, being at most $\frac{1}{100000}$ heavier. Sea water may be taken at 64 pounds per cubic foot.

6. *Compressibility of Liquids.*—The most accurate experiments show that liquids are sensibly compressed by very great pressures, and that up to a pressure of sixty-five atmospheres, or about 1,000 pounds per square inch, the compression is proportional to the pressure.

7. *Change of Volume and Density of Water with Change of Temperature.*—Although the change of volume of water with change of temperature is so small that it may generally be neglected in ordinary hydraulic calculations, yet it should be noted that there is a

change of volume which should be allowed for in very exact calculations.

8. *Relation of Pressure, Volume, Temperature and Density in Compressible Fluids.*—Certain problems on the flow of air and steam are so similar to those relating to the flow of water that they are conveniently treated together. It is necessary, therefore, to state as briefly as possible the properties of compressible fluids so far as knowledge of them is requisite in the solution of these problems. Air may be taken as a type of these fluids, and the data here given will relate to air.

Relation of Pressure and Volume at Constant Temperature.—At constant temperature the product of the pressure and volume of a given quantity of air is a constant.

9. Moving fluids as commonly observed are conveniently classified thus:—

(1) *Streams* are moving masses of indefinite length, completely or incompletely bounded laterally by solid boundaries. When the solid boundaries are complete, the flow is said to take place in a pipe. When the solid boundary is incomplete and leaves the upper surface of the fluid free, it is termed a stream bed or channel or canal.

(2) A stream bounded laterally by differently moving fluid of the same kind is termed a *current*.

(3) A *jet* is a stream bounded by fluid of a different kind.

(4) An *eddy*, *vortex*, or *whirlpool* is a mass of fluid the particles of which are moving circularly or spirally.

(5) In a stream we may often regard the particles as flowing along definite paths in space. A chain of particles following each other along such a constant path may be termed a fluid filament or elementary stream.

10. *Steady and Unsteady, Uniform and Varying Motion.*—There are two quite distinct ways of treating hydrodynamical questions. We may either fix attention on a given mass of fluid and consider its changes of position and energy under the action of the stresses to which it is subjected, or we may have regard to a given fixed portion of space and consider the volume and energy of the fluid entering and leaving that space.

If, in following a given path, a mass of water has a constant velocity, the motion is said to be uniform. The kinetic energy of the mass remains unchanged. If the velocity varies from point to point of the path, the motion is called varying motion. If at a given point in space, the particles of water always arrive with the same velocity and in the same direction, during any given time, then the motion is termed steady motion. On the contrary, if at any point the velocity or direction varies from moment to moment the motion is termed unsteady. Steady motion is sometimes termed permanent motion. A river which excavates its own bed is in unsteady motion so long as the slope and form of the bed are changing. It, however, tends always toward a condition in which the bed ceases to change, and it is then said to have reached a condition of permanent regime. No river probably is in absolutely permanent regime, except perhaps in rocky channels. In other cases the bed is scoured more or less during the rise of a flood, and silted again during the subsidence of the flood. But while many streams of a torrential character change the condition of their bed often and to a large extent, in others the changes are comparatively small and not easily observed.

As a stream approaches a condition which would be strictly defined as one of steady motion, its regime becomes permanent. Hence steady motion and permanent regime are sometimes used as meaning the same thing. The one, however, is a definite term applicable to the motion of the water, the other a less definite

term applicable in strictness only to the condition of the stream bed.

11. *Theoretical Notions on the Motion of Water.*—The actual motion of the particles of water is in most cases very complex. To simplify hydrodynamic problems, simpler modes of motion are assumed, and the results of theory so obtained are compared experimentally with the actual motions.

Motion in Plane Layers.—The simplest kind of motion in a stream is one in which the particles initially situated in any plane cross section of the stream continue to be found in plane cross sections during the subsequent motion. Thus, if the particles in a thin plane layer are found again in a thin plane layer after any interval of time, the motion is said to be motion in plane layers. In such motion the internal work in deforming the layer may usually be disregarded, and the resistance to the motion is confined to the circumference.

Laminar Motion.—In the case of streams having solid boundaries, it is observed that the central parts move faster than the lateral parts. To take account of these differences of velocity, the stream may be conceived to be divided into thin laminae, having cross sections somewhat similar to the solid boundary of the stream, and sliding on each other. The different laminae can then be treated as having differing velocities according to any law either observed or deduced from their mutual friction. A much closer approximation to the real motion of ordinary streams is thus obtained.

Stream Line Motion.—In the preceding hypothesis, all the particles in each lamina have the same velocity at any given cross section of the stream. If this assumption is abandoned, the cross section of the stream must be supposed divided into indefinitely small areas, each representing the section of a fluid filament. Then these filaments may have any law of variation of velocity assigned to them. If the motion is steady motion these fluid filaments (or, as they are then termed, *stream lines*) will have fixed positions in space.

Periodic Unsteady Motion.—In ordinary streams with rough boundaries, it is observed that at any given point the velocity varies from moment to moment in magnitude and direction, but that the average velocity for a sensible period (say for five or ten minutes) varies very little either in magnitude or velocity. It has hence been conceived that the variations of direction and magnitude of the velocity are periodic, and that, if for each point of the stream the mean velocity and direction of motion were substituted for the actual more or less varying motions, the motion of the stream might be treated as steady stream line or steady laminar motion.

12. When a liquid issues vertically from a small orifice, it forms a jet which rises nearly to the level of the free surface of the liquid in the vessel from which it flows. The difference of level is so small that it may be at once suspected to be due either to air resistance on the surface of the jet or to the viscosity of the liquid or to friction against the sides of the orifice. Neglecting for the moment this small quantity, we may infer, from the elevation of the jet, that each molecule on leaving the orifice possessed the velocity required to lift it against gravity to the height of the liquid in the vessel.

Contraction—Sharp-edged Orifices in Plane Surfaces.—When a jet issues from an aperture in a vessel, it may either spring clear from the inner edge of the orifice or it may adhere to the sides of the orifice. The former condition will be found if the orifice is beveled outward, so as to be sharp-edged, and it will also occur generally for a prismatic aperture, provided the thickness of the vessel around the aperture is less than the diameter of the jet. But if the thickness is greater the

fluid will be discharged in a volume whose diameter is equal to that of the orifice.

13. *Bellmouthed Orifices.*—If an orifice is furnished with a mouthpiece exactly of the form of the contracted vein, then the whole of the contraction occurs within the mouthpiece. It is often desirable to bellmouth the ends of pipes, to avoid the loss of head which occurs if this is not done; and such a bellmouth may also have the form of the contracted jet.

14. *Partially Suppressed Contraction.*—Since the contraction of the jet is due to the convergence toward the orifice of the issuing streams, it will be diminished if for any portion of the edge of the orifice the convergence is prevented. Thus, if an internal rim or border is applied to part of the edge of the orifice, the convergence for so much of the edge is suppressed.

15. *Imperfect Contraction.*—If the sides of the vessel approach near to the edge of the orifice, they interfere with the convergence of the streams to which the contraction is due, and the contraction is then modified. It is generally stated that the influence of the sides begins to be felt if their distance from the edge of the orifice is less than 2.7 times the corresponding width of the orifice.

16. *Orifices Furnished with Channels of Discharge.*—The external borders to an orifice also modify the contraction.

Inversion of the Jet.—When a jet issues from a horizontal orifice, or is of small size compared with the head, it presents no marked peculiarity of form. But if the orifice is in a vertical surface, and if its dimensions are not small compared with the head, it undergoes a series of singular changes of form after leaving the orifice.

The jet first contracts as described above, in consequence of the convergence of the fluid streams within the vessel, retaining, however, a form similar to that of the orifice. Afterward it expands into sheets in planes perpendicular to the sides of the orifice. Thus the jet from a triangular orifice expands into three sheets, in planes bisecting at right angles the three sides of the triangle.

17. *Practical Use of Orifices in Gauging Water.*—If the water to be measured is passed through a known orifice under an arrangement by which the constancy of the head is insured, the amount which passes in a given time can be ascertained. It will obviously be best to make the orifices of the forms for which the coefficients are most accurately determined; hence sharp-edged orifices or notches are most commonly used.

Water Inch.—For measuring small quantities of water circular sharp-edged orifices have been used. The discharge from a circular orifice one French inch in diameter, with a head of one line above the top edge, was termed by the older hydraulic writers a water inch. A common estimate of its value was fourteen pints per minute, or 677 English cubic feet in twenty-four hours. An experiment by Bossut gave 634 cubic feet in twenty-four hours (see Navier's edition of *Belidor's Arch. Hydr.*, p. 212).

Weisbach points out that measurements of this kind would be made more accurately with a greater head over the orifice, and he proposes that the head should be equal to the diameter of the orifice. Several equal orifices may be used for larger discharges.

18. *Pin Ferrules or Measuring Cocks.*—To give a tolerably definite supply of water to houses, without the expense of a meter, a ferrule with an orifice of a definite size, or a cock, is introduced in the service-pipe. If the head in the water main is constant, then a definite quantity of water would be delivered in a given time. The arrangement is not a very satisfactory one, and acts

chiefly as a check on extravagant use of water. It is interesting here chiefly as an example of regulation of discharge by means of an orifice. A cock of this kind is used at Zurich. It consists of three cocks, the middle one having the orifice of the predetermined size in a small circular plate, protected by wire gauze from stoppage by impurities in the water. The cock on the right hand can be used by the consumer for emptying the pipes. The one on the left and the measuring cock are connected by a key which can be locked by a padlock which is under the control of the water company.

19. *Measurement of the Flow in Streams.*—To determine the quantity of water flowing off the ground in small streams, which is available for water supply or for obtaining water power, small temporary weirs are often used. These may be formed of planks supported by piles and puddled to prevent leakage. The measurement of the head may be made by a thin-edged scale at a short distance behind the weir, where the water surface has not begun to slope down to the weir and where the velocity of approach is not high. The measurements are conveniently made from a short pile driven into the bed of the river, accurately level with the crest of the weir.

Gauging weirs are most commonly in the form of rectangular notches; and care should be taken that the crest is accurately horizontal, and that the weir is normal to the direction of flow of the stream. If the planks are thick they should be beveled, and the edge may be protected by a metal plate about $\frac{1}{10}$ inch thick to secure the requisite accuracy of form and sharpness of edge. In permanent gauging weirs a cast-steel plate is sometimes used to form the edge of the weir crest. The weir should be large enough to discharge the maximum volume flowing in the stream, and at the same time it is desirable that the minimum head should not be too small (say half a foot) to decrease the effects of errors of measurement. The section of the jet over the weir should not exceed one-fifth the section of the stream behind the weir, or the velocity of approach will need to be taken into account. A triangular notch is very suitable for measurements of this kind.

If the flow is variable, the head must be recorded at equidistant intervals of time, say twice daily, and then for each twelve-hour period the discharge must be calculated for the mean of the heads at the beginning and end of the time. As this involves a good deal of troublesome calculation, Mr. Sang has proposed to use a scale so graduated as to read off the discharge in cubic feet per second.

The accurate measurement of the discharge of a stream by means of a weir is, however, in practice, rather more difficult than might be inferred from the simplicity of the principle of the operation.

20. *Hook Gauge.*—For the determination of the surface level of water, the most accurate instrument is the hook gauge used first by Mr. U. Boyden of Boston, in 1840. It consists of a fixed frame with scale and vernier. In the instrument, the vernier is fixed to the frame, and the scale slides vertically. The scale carries at its lower end a hook with a fine point, and the scale can be raised or lowered by a fine pitched screw. If the hook is depressed below the water surface and then raised by the screw, the moment of its reaching the water surface will be very distinctly marked, by the reflection from a small capillary elevation of the water surface over the point of the hook. In ordinary light, differences of level of the water of .001 of a foot are easily detected by the hook gauge. If such a gauge is used to determine the heads at a weir, the hook should first be set accurately level with the weir crest, and a

reading taken. Then the difference of the reading at the water surface and that for the weir crest will be the head at the weir.

21. *Modules used in Irrigation.*—In distributing water for irrigation, the charge for the water may be simply assessed on the area of the land irrigated for each consumer, a method followed in India; or a regulated quantity of water may be given to each consumer, and the charge may be made proportional to the quantity of water supplied, a method employed for a long time in Italy and other parts of Europe. To deliver a regulated quantity of water from the irrigation channel, arrangements termed modules are used. These are constructions intended to maintain a constant or approximately constant head above an orifice of fixed size, or to regulate the size of the orifice so as to give a constant discharge, notwithstanding the variation of level in the irrigating channel.

22. *Italian Module.*—The Italian modules are masonry constructions, consisting of a regulating chamber, to which water is admitted by an adjustable sluice from the canal. At the other end of the chamber is an orifice in a thin flagstone of fixed size. By means of the adjustable sluice a tolerably constant head above the fixed orifice is maintained, and therefore there is a nearly constant discharge of ascertainable amount through the orifice, into the channel leading to the fields which are to be irrigated.

23. *Spanish Module.*—On the canal of Isabella II., which supplies water to Madrid, a module much more perfect in principle than the Italian module is employed. Part of the water is supplied for irrigation, and as it is very valuable its strict measurement is essential. The module consists of two chambers one above the other, the upper chamber being in free communication with the irrigation canal, and the lower chamber discharging by a culvert to the fields. In the arched roof between the chambers there is a circular sharp-edged orifice in a bronze plate. Hanging in this there is a bronze plug of variable diameter suspended from a hollow brass float. If the water level in the canal lowers, the plug descends and gives an enlarged opening, and conversely. Thus a perfectly constant discharge with a varying head can be obtained, provided no clogging or silting of the chambers prevents the free discharge of the water or the rise and fall of the float.

24. *Reservoir Gauging Basins.*—In obtaining the power to store the water of streams in reservoirs, it is usual to concede to riparian owners below the reservoirs a right to a regulated supply throughout the year. This compensation water requires to be measured in such a way that the millowners and others interested in the matter can assure themselves that they are receiving a proper quantity, and they are generally allowed a certain amount of control as to the times during which the daily supply is discharged into the stream.

25. *Steady Flow of Compressible Fluids.—External Work during the Expansion of Air.*—If air expands without doing any external work, its temperature remains constant. This result was first experimentally demonstrated by Joule. It leads to the conclusion that, however air changes its state, the internal work done is proportional to the change of temperature. When, in expanding, air does work against an external resistance, either heat must be supplied or the temperature falls.

26. *Friction of Liquids.*—When a stream of fluid flows over a solid surface, or conversely when a solid moves in still fluid, a resistance to the motion is generated, commonly termed fluid friction. It is due to the viscosity of the fluid, but generally the laws of fluid friction are very different from those of simple viscous

resistance. It would appear that at all speeds, except the slowest, rotating eddies are formed by the roughness of the solid surface, or by abrupt changes of velocity distributed throughout the fluid; and the energy expended in producing these eddying motions is gradually lost in overcoming the viscosity of the fluid in regions more or less distant from that where they are first produced.

The laws of fluid friction are generally stated thus:—

(1.) The frictional resistance is independent of the pressure between the fluid and the solid against which it flows. This may be verified by a simple direct experiment. Coulomb, for instance, oscillated a disk under water, first with atmospheric pressure acting on the water surface, afterward with the atmospheric pressure removed. No difference in the rate of decrease of the oscillations was observed. The chief proof that the friction is independent of the pressure is that no difference of resistance has been observed in water mains and in other cases, where water flows over solid surfaces under widely different pressures.

(2.) The frictional resistance of large surfaces is proportional to the area of the surface.

(3.) At low velocities of not more than one inch per second for water, the frictional resistance increases directly as the relative velocity of the fluid and the surface against which it flows. At velocities of one-half foot per second and greater velocities, the frictional resistance is more nearly proportional to the square of the relative velocity.

In many treatises on hydraulics it is stated that the frictional resistance is independent of the nature of the solid surface. The explanation of this was supposed to be that a film of fluid remained attached to the solid surface, the resistance being generated between this fluid layer and layers more distant from the surface. At extremely low velocities the solid surface does not seem to have much influence on the friction. In Coulomb's experiments a metal surface covered with tallow, and oscillated in water, had exactly the same resistance as a clean metal surface, and when sand was scattered over the tallow the resistance was only very slightly increased. The earlier calculations of the resistance of water at higher velocities in iron and wood pipes and earthen channels seemed to give a similar result. These, however, were erroneous, and it is now well understood that differences of roughness of the solid surface very greatly influence the friction, at such velocities as are common in engineering practice. Darcy's experiments, for instance, showed that in old and incrustated water mains the resistance was twice or sometimes thrice as great as in new and clean mains.

27. *Steady Flow of Water in Pipes of Uniform Section.*—The ordinary theory of the flow of water in pipes, on which all practical formulæ are based, assumes that the variation of the velocity at different points of any cross section may be neglected. The water is considered as moving in plane layers, which are driven through the pipe against the frictional resistance, by the difference of pressure at or elevation of the ends of the pipe. If the motion is steady the velocity at each cross section remains the same from moment to moment, and if the cross sectional area is constant the velocity at all sections must be the same. Hence the motion is uniform. The most important resistance to the motion of the water is the surface friction of the pipe, and it is convenient to estimate this independently of some smaller resistances which will be accounted for presently.

28. *Scraping Water Mains.*—The influence of the condition of the surface of a pipe on the friction is shown by various facts known to the engineers of

waterworks. Pipes are very often heated and dipped in pitch, which gives them a smooth, hard surface and protects them from oxidation. Such pipes are known to give a discharge larger than that calculated by the ordinary formulæ. In pipes which convey certain kinds of water oxidation proceeds rapidly, and the discharge is very perceptibly and sometimes very greatly diminished. In a main laid at Torquay the discharge diminished from this cause more than 50 per cent., and the supply became insufficient for the town. Mr. Appold suggested an apparatus for scraping the interior of the pipe, and this was constructed and tried under the direction of Mr. Froude. It was found that by scraping the interior of the pipe the discharge was increased 56 per cent. The scraping requires to be repeated at intervals. After each scraping the discharge diminishes rather rapidly to 10 per cent. and afterward more slowly, the diminution in a year being about 25 per cent.

FLOW OF COMPRESSIBLE FLUIDS IN PIPES.

29. *Flow of Air in Long Pipes.*—When air flows through a long pipe, by far the greater part of the work expended is used in overcoming frictional resistances due to the surface of the pipe. The work expended in friction generates heat, which for the most part must be developed in and given back to the air. Some heat may be transmitted through the sides of the pipe to surrounding materials, but in experiments hitherto made the amount so conducted away appears to be very small, and if no heat is transmitted the air in the tube must remain sensibly at the same temperature during expansion. In other words, the expansion may be regarded as isothermal expansion, the heat generated by friction exactly neutralizing the cooling due to the work done. Experiments on the pneumatic tubes used for the transmission of messages, by Messrs. Culley & Sabine, show that the change of temperature of the air flowing along the tube is much less than it would be in adiabatic expansion.

30. *Application to the Case of Pneumatic Tubes for the Transmission of Messages.*—In Paris, Berlin, London, and other towns, it has been found cheaper to transmit messages in pneumatic tubes than to telegraph by electricity. The tubes are laid underground with easy curves; the messages are made into a roll and placed in a light felt carrier, the resistance of which in the tubes in London is only $\frac{3}{4}$ oz. A current of air forced into the tube or drawn through it propels the carrier. In most systems the current of air is steady and continuous, and the carriers are introduced or removed without materially altering the flow of air.

31. *Flow of Water in Open Canals and Rivers.*—When water flows in a pipe the section at any point is determined by the form of the boundary. When it flows in an open channel with free upper surface, the section depends on the velocity due to the dynamical conditions.

Suppose water admitted to an unfilled canal. The channel will gradually fill, the section and velocity at each point gradually changing. But if the inflow to the canal at its head is constant, the increase of cross section and diminution of velocity at each point attain after a time a limit. Thenceforward the section and velocity at each point are constant, and the motion is steady, or permanent regime is established.

32. *Experimental Observations on the Vertical Velocity Curve.*—In obtaining the vertical velocity curve from direct observations in streams, a preliminary difficulty arises from the fact that the velocity at any given depth is not constant, and hence the motion in the strict

sense is not steady. The velocities taken on a given vertical section at any given moment do not form, when plotted, any regular curve. But if a series of observations are taken at each depth and the results averaged, the mean velocities at each depth, when plotted, give a regular curve, agreeing very fairly with the parabola, which might be expected from the theory above. Hence it may be inferred that the velocity at any given point fluctuates about a mean value, the fluctuations being due to irregular eddying motions superposed on the general steady motion of the stream, and having an effect which disappears in the mean of a series of observations. For certain purposes these irregular motions may be ignored, and the constant mean velocity substituted for the actual varying velocities at each point. In the next place, all the best observations show that the maximum velocity is to be found, not at the free surface of the stream, but at some distance below it.

Influence of the Wind.—In the experiments on the Mississippi the vertical velocity curve in calm weather was found to agree fairly with a parabola, the greatest velocity being at three-tenths of the depth of the stream from the surface. With a wind blowing down-stream the surface velocity is increased, and the axis of the parabola approaches the surface. On the contrary, with a wind blowing up-stream the surface velocity is diminished, and the axis of the parabola is lowered, sometimes to half the depth of the stream. The American observers drew from their observations the conclusion that there was an energetic retarding action at the surface of a stream like that due to the bottom and sides. If there were such a retarding action the position of the filament of maximum velocity below the surface would be explained.

It is not difficult to understand that a wind acting on surface ripples should accelerate or retard the surface motion of the stream, and the Mississippi results may be accepted so far as showing that the surface velocity of a stream is variable when the mean velocity of the stream is constant. Hence observations of surface velocity by floats or otherwise should only be made in very calm weather. But it is very difficult to suppose that, in still air, there is a resistance at the free surface of the stream at all analogous to that at the sides and bottom. Further, in very careful experiments, Boileau found the maximum velocity, though raised a little above its position for calm weather, still at a considerable distance below the surface, even when the wind was blowing down-stream with a velocity greater than that of the stream, and when the action of the air must have been an accelerating and not a retarding action. Prof. James Thomson has given a much more probable explanation of the diminution of the velocity at and near the free surface. He points out that portions of water, with a diminished velocity from retardation by the sides or bottom, are thrown off in eddying masses and mingle with the rest of the stream. These eddying masses modify the velocity in all parts of the stream, but have their greatest influence at the free surface. Reaching the free surface, they spread out and remain there, mingling with the water at that level and diminishing the velocity which would otherwise be found there.

33. *Influence of the Wind on the Depth at which the Maximum Velocity is found.*—In the gaugings of the Mississippi the vertical velocity curve was found to agree well with a parabola having a horizontal axis at some distance below the water surface, the ordinate of the parabola at the axis being the maximum velocity of the section. During the gaugings the force of the wind was registered on a scale ranging from 0 for a calm to 10 for a hurricane. Arranging the velocity curves in

three sets—(1) with the wind blowing up-stream, (2) with the wind blowing down-stream, (3) calm or wind blowing across-stream—it was found that an up-stream wind lowered, and a down-stream wind raised, the axis of the parabolic velocity curve. In calm weather the axis was at three-tenths of the total depth from the surface for all conditions of the stream.

34. *River Bends.*—In rivers flowing in alluvial plains, the windings which already exist tend to increase in curvature by the scouring away of material from the outer bank and the deposition of detritus along the inner bank. The sinuosities sometimes increase till a loop is formed with only a narrow strip of land between the two encroaching branches of the river. Finally a “cut-off” may occur, a waterway being opened through the strip of land and the loop left separated from the stream, forming a horseshoe-shaped lagoon or marsh. Professor James Thomson has pointed out that the usual supposition is that the water tending to go forward in a straight line, rushes against the outer bank and scours it, at the same time creating deposits at the inner bank. That view is very far from a complete account of the matter, and Professor Thomson has given a much more ingenious account of the action at the bend, which he has completely confirmed by experiment.

When water moves around a circular curve under the action of gravity only, it takes a motion like that in a free vortex. Its velocity is greater parallel to the axis of the stream at the inner than at the outer side of the bend. Hence the scouring at the outer side and the deposit at the inner side of the bend are not due to mere difference of velocity of flow in the general direction of the stream; but, in virtue of the centrifugal force, the water passing around the bend presses outward, and the free surface in a radial cross section has a slope from the inner side upward to the outer side. For the greater part of the water flowing in curved paths, this difference of pressure produces no tendency to transverse motion. But the water immediately in contact with the rough bottom and sides of the channel is retarded, and its centrifugal force is insufficient to balance the pressure due to the greater depth at the outside of the bend. It therefore flows inward toward the inner side of the bend, carrying with it detritus which is deposited at the inner bank. Conjointly with this flow inward along the bottom and sides, the general mass of water must flow outward to take its place.

35. *Steady Motion of Water in Open Channels of Varying Cross Section and Slope.*—In every stream the discharge of which is constant, or may be regarded as constant for the time considered, the velocity at different places depends on the slope of the bed. Except at certain exceptional points the velocity will be greater as the slope of the bed is greater, and, as the velocity and cross section of the stream vary inversely, the section of the stream will be least where the velocity and slope are greatest. If in a stream of tolerably uniform slope an obstruction such as a weir is built, that will cause an alteration of flow similar to that of an alteration of the slope of the bed for a greater or less distance above the weir, and the originally uniform cross section of the stream will become a varied one. In such cases it is often of much practical importance to determine the longitudinal section of the stream.

36. *On Streams and Rivers.—Catchment Basin.*—A stream or river is the channel for the discharge of the available rainfall of a district, termed its catchment basin. The catchment basin is surrounded by a ridge or watershed line, continuous except at the point where the river finds an outlet. The area of the catchment basin may be determined from a suitable contoured map

on a scale of at least 1 in 100,000. Of the whole rainfall on the catchment basin, a part only finds its way to the stream. Part is directly re-evaporated, part is absorbed by vegetation, part may escape by percolation into neighboring districts.

37. *Flood Discharge*.—The flood discharge can generally only be determined by examining the greatest height to which floods have been known to rise. To produce a flood the rainfall must be heavy and widely distributed, and to produce a flood of exceptional height the duration of the rainfall must be so great that the floodwaters of the most distant affluents reach the point considered, simultaneously with those from nearer points. The larger the catchment basin the less probable is it that all the conditions tending to produce a maximum discharge should simultaneously occur. Further, lakes and the river bed itself act as storage reservoirs during the rise of water level and diminish the rate of discharge, or serve as flood moderators. The influence of these is often important, because very heavy rainstorms are in most countries of comparatively short duration.

38. *Action of a Stream on its Bed*.—If the velocity of a stream exceeds a certain limit, depending on its size, and on the size, heaviness, form, and coherence of the material of which its bed is composed, it scours its bed and carries forward the materials. The quantity of material which a given stream can carry in suspension depends on the size and density of the particles in suspension, and is greater as the velocity of the stream is greater. If in one part of its course the velocity of a stream is great enough to scour the bed and the water becomes loaded with silt, and in a subsequent part of the river's course the velocity is diminished, then part of the transported material must be deposited. Probably deposit and scour go on simultaneously over the whole river bed, but in some parts the rate of scour is in excess of the rate of deposit, and in other parts the rate of deposit is in excess of the rate of scour. Deep streams appear to have the greatest scouring power at any given velocity. It is possible that the difference is strictly a difference of transporting, not of scouring action.

39. *Regime of a River Channel*.—A river channel is said to be in a state of regime, or stability, when it changes little in draught or form in a series of years. In some rivers the deepest part of the channel changes its position perpetually, and is seldom found in the same place in two successive years. The sinuousness of the river also changes by the erosion of the banks, so that in time the position of the river is completely altered. In other rivers the change from year to year is very small, but probably the regime is never perfectly stable except where the rivers flow over a rocky bed.

If a river had a constant discharge it would gradually modify its bed till a permanent regime was established. But as the volume discharged is constantly changing, and therefore the velocity, silt is deposited when the velocity decreases, and scour goes on when the velocity increases in the same place. When the scouring and silting are considerable, a perfect balance between the two is rarely established, and hence continual variations occur in the form of the river and the direction of its currents. In other cases, where the action is less violent, a tolerable balance may be established, and the deepening of the bed by scour at one time is compensated by the silting at another. In that case the general regime is permanent, though alteration is constantly going on. This is more likely to happen if by artificial means the erosion of the banks is prevented. If a river flows in soil incapable of resisting its tendency to scour it is necessarily sinuous, for the slightest deflexion of the current to either side begins an erosion which in-

creases progressively till a considerable bend is formed. If such a river is straightened it becomes sinuous again unless its banks are protected from scour.

40. *Longitudinal Section of River Bed*.—The declivity of rivers decreases from source to mouth. In their higher parts rapid and torrential, flowing over beds of gravel or boulders, they enlarge in volume by receiving affluent streams, their slope diminishes, their bed consists of smaller materials, and finally they reach the sea.

41. *Surface Level of River*.—The surface level of a river is a plane changing constantly in position from changes in the volume of water discharged, and more slowly from changes in the river bed, and the circumstances affecting the drainage into the river.

For the purposes of the engineer, it is important to determine (1) the extreme low-water level, (2) the extreme high-water or flood level, and (3) the highest navigable level.

(1) *Low-Water Level* cannot be absolutely known, because a river reaches its lowest level only at rare intervals, and because alterations in the cultivation of the land, the drainage, the removal of forests, the removal or erection of obstructions in the river bed, etc., gradually alter the conditions of discharge. The lowest level of which records can be found is taken as the conventional or approximate low-water level, and allowance is made for possible changes.

(2) *High Water or Flood Level*.—The engineer assumes as the highest flood level the highest level of which records can be obtained. In forming a judgment of the data available, it must be remembered that the highest level at one point of a river is not always simultaneous with the attainment of the highest level at other points, and that the rise of a river in flood is very different in different parts of its course. In temperate regions, the floods of rivers seldom rise more than twenty feet above low water level, but in the tropics the rise of floods is greater.

(3) *Highest Navigable Level*.—When the river rises above a certain level, navigation becomes difficult from the increase of the velocity of the current, or from submersion of the towpaths, or from the headway under bridges becoming insufficient. Ordinarily the highest navigable level may be taken to be that at which the river begins to overflow its banks.

42. *Relative Value of Different Materials for Submerged Works*.—That the power of water to remove and transport different materials depends on their density has an important bearing on the selection of materials for submerged works. In many cases, as in the aprons or floorings beneath bridges, or in front of locks or falls, and in the formation of training walls and breakwaters by *pierres perdues*, which have to resist a violent current, the materials of which the structures are composed should be of such a size and weight as to be able individually to resist the scouring action of the water. The heaviest materials will therefore be the best; and the different value of materials in this respect will appear much more striking, if it is remembered that all materials lose part of their weight in water.

43. *Inundation Deposits from a River*.—When a river carrying silt periodically overflows its banks, it deposits silt over the area flooded, and gradually raises the surface of the country. The silt is deposited in greatest abundance where the water first leaves the river. It hence results that the section of the country assumes a peculiar form, the river flowing in a trough along the crest of a ridge, from which the land slopes downward on both sides. The silt deposited from the water forms two wedges, having their thick ends toward the river.

This is strikingly the case with the Mississippi, and that river is now kept from flooding immense areas by artificial embankments or levees. In India, the term *deltaic segment* is sometimes applied to that portion of a river running through deposits formed by inundation, and having this characteristic section. The irrigation of the country in this case is very easy; a comparatively slight raising of the river surface by a weir or annicut gives a command of level which permits the water to be conveyed to any part of the district.

44. *Deltas*.—The name delta was originally given to the Δ -shaped portion of Lower Egypt, included between seven branches of the Nile. It is now given to the whole of the alluvial tracts around river mouths formed by deposition of sediment from the river, where its velocity is checked on its entrance to the sea. The characteristic feature of these alluvial deltas is that the river traverses them, not in a single channel, but in two or many bifurcating branches. Each branch has a tract of the delta under its influence, and gradually raises the surface of that tract, and extends it seaward. As the delta extends itself seaward, the conditions of discharge through the different branches change. The water finds the passage through one of the branches less obstructed than through the others; the velocity and scouring action in that branch are increased; in the others they diminish. The one channel gradually absorbs the whole of the water supply, while the other branches silt up. But as the mouth of the new main channel extends seaward the resistance increases both from the greater length of the channel and the formation of shoals at its mouth, and the river tends to form new bifurcations, and one of these may in time become the main channel of the river.

45. *Field Operations preliminary to a Study of River Improvement*.—There are required (1) a plan of the river, on which the positions of lines of leveling and cross sections are marked; (2) a longitudinal section and numerous cross sections of the river; (3) a series of gaugings of the discharge at different points and in different conditions of the river.

Longitudinal Section.—This requires to be carried out with great accuracy. A line of stakes is planted, following the sinuosities of the river and chained and leveled. The cross sections are referred to the line of stakes, both as to position and direction. To determine the slope of the water surface great care is necessary.

46. *Cross Sections*.—A stake is planted flush with the water, and its level relatively to some point on the line of levels is determined. Then the depth of the water is determined at a series of points (if possible at uniform distances) in a line starting from the stake and perpendicular to the thread of the stream. To obtain these, a wire may be stretched across with equal distances marked on it by hanging tags. The depth at each of these tags may be obtained by a light wooden staff, with a disk-shaped shoe four to six inches in diameter. If the depth is great, soundings may be taken by a chain and weight. To insure the wire being perpendicular to the thread of the stream, it is desirable to stretch two other wires similarly graduated, one above and the other below, at a distance of twenty to forty yards. A number of floats being then thrown in, it is observed whether they pass the same graduation on each wire.

47. *Measurement of the Discharge of Rivers*.—The area of cross section multiplied by the mean velocity gives the discharge of the stream. The height of the river with reference to some fixed mark should be noted whenever the velocity is observed, as the velocity and area of cross section are different in different states of the river. To determine the mean velocity

various methods may be adopted; and, since no method is free from liability to error, either from the difficulty of the observations or from uncertainty as to the ratio of the mean velocity to the velocity observed, it is desirable that more than one method should be used.

48. *Instruments for Measuring the Velocity of Water*.—*Surface Floats* are convenient for determining the surface velocities of a stream, though their use is difficult near the banks. The floats may be small balls of wood, of wax, or of hollow metal, so loaded as to float nearly flush with the water surface. To render them visible they may have a vertical painted stem. In experiments on the Seine, cork balls one and three-fourth inches in diameter were used, loaded to float flush with the water, and provided with a stem. In Captain Cunningham's observations at Roorkee, the floats were thin circular disks of English deal, three inches diameter and one-fourth of an inch thick. For observations near the banks, floats one inch in diameter and one-eighth of an inch thick were used. To render them visible a tuft of cotton wool was used loosely fixed in a hole at the center.

49. *Sub-surface Floats*.—The velocity at different depths below the surface of a stream may be obtained by sub-surface floats, used precisely in the same way as surface floats. The most usual arrangement is to have a large float, of slightly greater density than water, connected with a small and very light surface float. The motion of the combined arrangement is not sensibly different from that of the large float, and the small surface float enables an observer to note the path and velocity of the sub-surface float. The instrument is, however, not free from objection. If the large submerged float is made of very nearly the same density as water, then it is liable to be thrown upward by very slight eddies in the water, and it does not maintain its position at the depth at which it is intended to float. On the other hand, if the large float is made sensibly heavier than water, the indicating or surface float must be made rather large, and then it to some extent influences the motion of the submerged float.

Impact and Reaction of Water.—When a stream of fluid impinges on a solid surface, it presses on the surface with a force equal and opposite to that by which the velocity and direction of motion of the fluid are changed. Generally, in problems on the impact of fluids, it is necessary to neglect the effect of friction between the fluid and the surface on which it moves.

50. *During Impact the Velocity of the Fluid relatively to the Surface on which it impinges remains unchanged in Magnitude*.—Consider a mass of fluid flowing in contact with a solid surface also in motion, the motion of both fluid and solid being estimated relatively to the earth. Then the motion of the fluid may be resolved into two parts, one a motion equal to that of the solid, and in the same direction, the other a motion relatively to the solid. The motion which the fluid has in common with the solid cannot at all be influenced by the contact. The relative component of the motion of the fluid can only be altered in direction, and not in magnitude. The fluid moving in contact with the surface can only have a relative motion parallel to the surface, while the pressure between the fluid and solid, if friction is neglected, is normal to the surface. The pressure, therefore, can only deviate the fluid, without altering the magnitude of the relative velocity. The unchanged common component and, combined with it, the deviated relative component give the resultant final velocity, which may differ greatly in magnitude and direction from the initial velocity.

51. Down to a recent period the resistance of ships was supposed to be due to a difference between the

pressure on the bow and stern, caused by the pushing aside of the water. Hence the resistance was supposed to be proportional to the immersed midship sectional area of the vessel. In a "fair" body, completely immersed, there is no resistance of this kind, the pressure of the water closing in behind exactly balancing the excess of pressure on the bow. In such a body, therefore, the resistance is almost entirely due to the frictional drag of the water on the surface of the body, and is proportional to its skin area. In a ship, which is only partially immersed, a further resistance, which in some cases becomes very large, is due to the alteration of the surface level of the water causing a dissipation of energy in producing waves.

52. Hydraulic Machinery.—Hydraulic machinery may be broadly divided into hydraulic motor machines and pumps. In the former class, a quantity of water descending from a higher to a lower level, or from a higher to a lower pressure, drives a machine which receives energy from the water, and applies it to overcoming the resistances of other machines doing useful work. In the latter class, work done on the machine by a steam engine or other source of energy is employed in lifting water from a lower to a higher level. A few machines such as the ram and jet pump combine the functions of motors and pumps.

In every system of machinery deriving energy from a natural waterfall there exist the following parts:

(1) A supply channel or head race, leading the water from the highest accessible level to the site of the machine. This may be an open channel of earth, masonry, or wood, laid at as small a slope as is consistent with the delivery of the necessary supply of water, or it may be a closed cast or wrought-iron pipe, laid at the natural slope of the ground, and about three feet below the surface. In some cases part of the head race is an open channel, part a closed pipe. The channel often starts from a small storage reservoir, constructed near the stream supplying the water motor, in which the water accumulates when the motor is not working. There are sluices or penstocks by which the supply can be cut off when necessary.

(2) Leading from the motor there is a tail race, culvert, or discharge pipe delivering the water after it has done its work at the lowest convenient level.

(3) A waste channel, weir, or by-wash is placed on or at the origin of the head race, by which surplus water, in floods, escapes.

(4) The motor itself, of one of the kinds to be described presently, which either overcomes a useful resistance directly, as in the case of a ram acting on a lift or crane chain, or indirectly by actuating transmissive machinery, as when a turbine drives the shafting, belting, and gearing of a mill. With the motor is usually combined regulating machinery for adjusting the power and speed to the work done. This may be controlled in some cases by automatic governing machinery.

Water Motors with Artificial Sources of Energy.—The great convenience and simplicity of water motors has led to their adoption in certain cases, where no natural source of water power is available. In these cases, an artificial source of water power is created by using a steam engine to pump water to a reservoir at a great elevation, or to pump water into a closed reservoir in which there is great pressure. The water flowing from the reservoir through hydraulic engines gives back the energy expended, less so much as has been wasted in friction. Such arrangements are most useful where a continuously acting steam engine stores up energy by pumping the water, while the work done by the hydraulic engines is done intermittently.

Wherever a stream flows from a higher to a lower

level it is possible to erect a water motor. The amount of power obtainable depends on the available head and the supply of water. In choosing a site the engineer will select a portion of the stream where there is an abrupt natural fall, or at least a considerable slope of the bed. He will have regard to the facility of constructing the channels which are to convey the water, and will take advantage of any bend in the river which enables him to shorten them. He will have accurate measurements made of the quantity of water flowing in the stream, and he will endeavour to ascertain the average quantity available throughout the year, the minimum quantity in dry seasons, and the maximum for which by-wash channels must be provided. In many cases the natural fall can be increased by a dam or weir thrown across the stream. The engineer will also examine to what extent the head will vary in different seasons, and whether it is necessary to sacrifice part of the fall and give a steep slope to the tail race to prevent the motor being drowned by backwater in floods.

In designing or selecting a water motor it is not sufficient to consider only its efficiency in normal conditions of working. It is generally quite as important to know how it will act with a scanty water supply or a diminished head. The greatest difference in water motors is in their adaptability to varying conditions of working.

Water motors may be divided into water-pressure engines, water wheels, and turbines.

Water-pressure engines are machines with a cylinder and piston or ram, in principle identical with the corresponding part of a steam engine. The water is alternately admitted to and discharged from the cylinder, causing a reciprocating action of the piston or ram. It is admitted at a high pressure and discharged at a low one, and consequently work is done on the piston. The water in these machines never acquires a high velocity, and for the most part the kinetic energy of the water is wasted. The useful work is due to the difference of the pressure of admission and discharge, whether that pressure is due to the weight of a column of water of more or less considerable height, or is artificially produced in ways to be described presently.

Water wheels are large vertical wheels driven by water falling from a higher to a lower level. In most water wheels, the water acts directly by its weight loading one side of the wheel and so causing rotation. But in all water wheels a portion and in some a considerable portion of the work due to gravity is first employed to generate kinetic energy in the water; during its action on the water wheel the velocity of the water diminishes, and the wheel is therefore in part driven by the impulse due to the change of the water's momentum. Water wheels are therefore motors on which the water acts, partly by weight, partly by impulse.

Turbines are wheels, generally of small size compared with water wheels, driven chiefly by the impulse of the water. Before entering the moving part of the turbine, the water is allowed to acquire a considerable velocity; during its action on the turbine this velocity is diminished, and the impulse due to the change of momentum drives the turbine.

Roughly speaking, the fluid acts in a water-pressure engine directly by its pressure, in a water wheel chiefly by its weight causing a pressure, but in part by its kinetic energy, and in a turbine chiefly by its kinetic energy, which again causes a pressure.

Water-Pressure Engines.—In these water acts by simple pressure due to the height of the column in the supply pipe or the pressure in the supply reservoir. The water acts on a piston or ram which it displaces

When the height of the column exceeds 100 or 200 feet, or there is a pressure equivalent to this, water wheels are inapplicable, and turbines have the disadvantage that in such circumstances their speed is very great. Then water-pressure engines may be very conveniently adopted. In other cases they are generally too cumbrous.

When an incompressible fluid such as water is used to actuate piston engines, two special difficulties arise. One is that the waste of work in friction is very great, if the water attains considerable velocity; another is that there is great straining action on the machinery. The violent straining action due to the more or less sudden arrest of the motion of water in machinery is termed hydraulic shock. For these reasons the maximum velocity of flow of water in hydraulic machines should generally not exceed five to ten feet per second. Under very high pressure, where there is less object in economizing energy, and it is very important to keep the dimensions of the machinery small, Mr. Anderson gives twenty-four feet per second as the limiting velocity. In large water-pressure engines used for pumping mines, the average piston speed does not exceed one-half to two feet per second.

HYDROMETER. The object of the hydrometer is the determination of the density of bodies, generally of fluids, but some forms of the instrument are adapted to the determination of the density of solids.

It is shown that, when a body floats in a fluid under the action of gravity, the weight of the body is equal to that of the fluid which it displaces. It is upon this principle that the hydrometer is constructed, and it obviously admits of two modes of application in the case of fluids; either we may compare the weights of floating bodies which are capable of displacing the same volume of different fluids, or we may compare the volumes of the different fluids which are displaced by the same weight. In the latter case, the densities of the fluids will be inversely proportional to the volumes thus displaced.

Perhaps the simplest method of experimentally determining the densities of different liquids is afforded by the series of areometrical glass beads, or hollow balls, first proposed by Doctor Wilson, professor of astronomy in the university of Glasgow. As subsequently improved by Mrs. Lovi, these beads were constructed in sets, each bead in the set differing in density from its predecessor by .002 (of the density of water). Each bead is numbered according to its density, and in order to determine the specific gravity of a liquid it is only necessary to throw into it the set of beads, or so many of them as are known to include between their extremes the density of the liquid, when all the beads whose densities exceed that of the liquid will sink, while those whose densities are less than that of the liquid will float. If there is a bead of exactly the same density as the liquid, it will rest in any position, provided it is completely immersed. Failing this, all that is immediately apparent is that the density is intermediate between that of the lightest bead that sinks and that of the heaviest that floats.

The hydrometer is said by Synesius Cyrenæus in his fifth letter to have been invented by Hypatia, at Alexandria, but appears to have been neglected until it was reinvented by Robert Boyle, whose "New Essay Instrument," as described in the *Phil. Trans.* for June, 1675, differs in no essential particular from Nicholson's hydrometer. This instrument was devised for the purpose of detecting counterfeit coin, especially guineas and half-guineas. In the first section of the paper the author refers to a glass instrument exhibited by himself many years before, and "consisting of a bubble furnished with a long and slender stem, which was to be put into several liquors, to compare and estimate their

specific gravities." This seems to be the first reference to the hydrometer in modern times.

The first hydrometer intended for the determination of the densities of liquids, and furnished with a set of weights to be attached when necessary, was that constructed by Mr. Clarke, and described by Desaguliers in the *Philosophical Transactions* for March and April, 1730.

Clarke's hydrometer, as afterward constructed for the purposes of the excise, was provided with thirty-two weights to adapt it to spirits of different specific gravities, and eleven smaller weights, or "weather weights," as they were called, which were attached to the instrument in order to correct for variations of temperature. The weights were adjusted for successive intervals of 5° Fahr., but for degrees intermediate between these no additional correction was applied. The correction for temperature thus afforded was not sufficiently accurate for excise purposes, and Mr. Speer in his essay on the hydrometer mentions cases in which this imperfect compensation led to the extra duty payable upon spirits which were more than 10 per cent. over proof being demanded on spirits which were purposely diluted to below 10 per cent. over proof in order to avoid the charge.

Desaguliers himself constructed a hydrometer of the ordinary type for comparing the specific gravities of different kinds of water. In order to give great sensibility to the instrument, the large glass ball was made nearly three inches in diameter, while the stand consisted of a wire ten inches in length and only $\frac{1}{40}$ inch in diameter. The instrument weighed 4,000 grains, and the addition of a grain caused it to sink through an inch. By altering the quantity of the shot in the small balls the instrument could be adapted for liquids other than water.

To an instrument constructed for the same purpose, but on a still larger scale than that of Desaguliers, M. Deparcieux added a small dish on the top of the stem for the reception of the weights necessary to sink the instrument to a convenient depth. The effect of weights placed in such a dish or pan is, of course, the same as if they were placed within the bulb of the instrument, since they do not alter the volume of that part which is immersed.

The first important improvement in the hydrometer after its re-invention by Boyle was introduced by Fahrenheit, who adopted the second mode of construction above referred to, arranging his instrument so as always to displace the same volume of liquid, its weight being varied accordingly. Instead of a scale, only a single mark is placed upon the stem, which is very slender, and bears at the top a small scale pan into which weights are placed until the instrument sinks to the mark upon its stem. The volume of the displaced liquid being then always the same, its density will be proportional to the whole weight supported, that is, to the weight of the instrument together with the weights required to be placed in the scale pan.

In comparing the densities of different liquids, it is clear that this instrument is precisely equivalent to that of Fahrenheit, and must be employed in the same manner, weights being placed in the top scale only until the hydrometer sinks to the mark on the wire, when the specific gravity of the liquid will be proportioned to the weight of the instrument together with the weights in the scale.

In the subsequent portion of the paper above referred to, Nicholson explains how the instrument may be employed as a thermometer, since, fluids generally expanding more than the solids of which the instrument is constructed, the instrument will sink as the temperature rises.

To determine the density of solids heavier than water with this instrument, let the solid be placed in the upper scale pan, and let the weight now required to cause the instrument to sink in distilled water at standard temperature to the mark B be denoted by w , while W denotes the weight required when the solid is not present. Then $W - w$ is the weight of the solid. Now let the solid be placed in the lower pan, care being taken that no bubbles of air remain attached to it, and let w_1 be the weight now required in the scale pan. This weight will exceed w in consequence of the water displaced by the solid, and the weight of the water thus displaced will be $w_1 - w$, which is therefore the weight of a volume of water equal to that of the solid. Hence, since the weight of the solid itself is $W - w$, its density

$$\text{must be } \frac{W - w}{w_1 - w}.$$

The above example illustrates how Nicholson's or Fahrenheit's hydrometer may be employed as a weighing machine for small weights.

In all hydrometers in which a part only of the instrument is immersed, there is a liability to error in consequence of the surface tension, or capillary action, as it is frequently called, along the line of contact of the instrument and the surface of the liquid (see CAPILLARY ACTION). This error diminishes as the diameter of the stems is reduced, but is sensible in the case of the thinnest stem which can be employed, and is the chief source of error in the employment of Nicholson's hydrometer, which otherwise would be an instrument of extreme delicacy and precision. The following is Nicholson's statement on this point:—

"One of the greatest difficulties which attends hydrostatical experiments arises from the attraction or repulsion that obtains at the surface of the water. After trying many experiments to obviate the irregularities arising from this cause, I find reason to prefer the simple one of carefully wiping the whole instrument, and especially the stem, with a clean cloth. The weights in the dish must not be esteemed accurate while there is either a cumulus or a cavity in the water around the stem."

HYDROPATHY is the treatment of disease by water, used outwardly and inwardly. Like many descriptive names, the word "hydropathy" is defective and even misleading, the active agents in the treatment being heat and cold, of which water is little more than the vehicle, and not the only one. Thermo-therapeutics (or thermotherapy) is a term less open to objection. The name "hydropathy," however, as being itself an advance on an earlier and less happy designation, "the water cure," as having obtained general currency, is here employed.

Hydropathy, as a system, or mode of treatment complete in itself, dates from about 1829, when Vincenz Priessnitz (1801–51), a farmer of Gräfenberg in Silesia, Austria, began his public career in the paternal homestead, extended so as to accommodate the increasing numbers attracted by the fame of his cures. Two English works, however, on the medical uses of water had been translated into German in the century preceding the rise of the movement under Priessnitz. One of these was by Sir John Floyer, a physician of Lichfield, who, struck by the remedial use of certain springs by the neighboring peasantry, investigated the history of cold bathing, and published in 1702 his *History of Cold Bathing, both Ancient and Modern*. The other work was that of Doctor Currie of Liverpool, entitled *Medical Reports on the Effects of Water, Cold and Warm, as a Remedy in Fevers and other Diseases*, published in 1797, and soon after translated into German.

It was highly popular, and first placed the subject on a scientific basis. Hahn's writings had meanwhile created much enthusiasm among his countrymen, societies having been everywhere formed to promote the medicinal and dietetic use of water; and in 1804 Professor Oertel of Ansbach republished them and quickened the popular movement by unqualified commendation of water drinking as a remedy for all diseases. In him the rising Priessnitz found a zealous advocate, and doubtless an instructor also. The origin of hydropathy is thus to be traced to an English source and to the medical profession. The broad conception that water had curative relations to the whole realm of disease seems to have been first grasped by a Capuchin monk of Sicily, Father Bernardo, who, at Malta, in 1724, obtained results by iced water alone, which, according to Hahn, caused a great stir throughout Europe; but, owing to the excesses of his imitators, it was of no long duration. With this exception there is, as regards the remedial use of water, nothing in the history of medicine that approaches in completeness the system of Priessnitz, though much leading up to it can be discovered. Among most primitive peoples, indeed, both in the Old and in the New World, the existence of one kind or another of hydropathic practice can be traced; and the fathers of medicine made frequent reference in their writings to the employment of water. The warm bath came into use at an early period (see BATHS); and the clyster, shower bath, douche, plunge, wet compress, drop bath, head and foot baths, are mentioned from time to time, as also combinations of heat and cold and primitive modes of sweating, until, before the end of the seventeenth century, all the processes of modern hydropathy, the wet sheet pack and induced cutaneous crisis alone excepted, had become known and were in a measure practiced.

At Gräfenberg, to which the fame of Priessnitz drew people of every rank and many countries, medical men were conspicuous by their numbers, some being attracted by curiosity, others by the desire of knowledge, but the majority by the hope of cure for ailments which had as yet proved incurable. Many records of experiences at Gräfenberg were published, all more or less favorable to the claims of Priessnitz, and some enthusiastic in their estimate of his genius and penetration; and from these alone can a knowledge of his practice and views be obtained, not a line having ever been written by this singular man. To Captain Claridge was due the introduction in 1840 of hydropathy to England, his writings and lectures, and later those of Doctors Wilson, Gully, and Edward Johnson, making numerous converts, and filling the establishments opened soon after at Malvern and elsewhere. In Germany, France, and America hydropathic establishments multiplied with great rapidity. Antagonism ran high between the old practice and the new. Unsparing condemnation was heaped by each on the other; and a legal prosecution, leading to a royal commission of inquiry, served but to make Priessnitz and his system stand higher in public estimation.

But increasing popularity diminished before long that timidity which hitherto had in great measure prevented trial of the new method from being made on the weaker and more serious class of cases, and had caused hydropathists to occupy themselves mainly with a sturdy order of chronic invalids well able to bear a rigorous regimen and the severities of unrestricted crisis. The need of a radical adaptation to the former class was first adequately recognized by John Smedley, a manufacturer of Derbyshire, who, impressed in his own person with the severities as well as the benefits of "the cold water cure," practiced among his workpeople a milder form of

hydropathy, and began about 1852 a new era in its history, founding at Matlock a counterpart of the establishment at Gräfenberg.

While hydropathy as a system has been gaining favor with the people, and receiving ample acknowledgment from the more liberal members of the medical profession, individual measures have from time to time been advocated in the medical journals and adopted more or less widely in particular diseases. Brand of Berlin, Räljen and Jürgensen of Kiel, and Liebermeister of Basel, between 1860 and 1870, employed the cooling bath in abdominal typhus with results which, after every deduction on the score of defective classification had been made, were striking enough, and led to its introduction to England by Dr. Wilson Fox, whose able monograph commanded general acceptance. In the Franco-German war the cooling bath was largely employed, in conjunction frequently with quinine; and it now holds a recognized position in the treatment of hyperpyrexia. The wet sheet pack has of late been much used in fevers of all kinds, both in private and hospital practice; and the Turkish bath, introduced about twenty-four years ago by Mr. David Urquhart on his return from the East, and ardently adopted by Mr. Barter of Cork, has become a public institution, and, with the "morning tub" and the general practice of water drinking, is the most noteworthy of the many contributions by hydropathy to public health.

The theoretical basis of hydropathy is wide and fundamental enough to include within its scope all disease. Each individual cell of the mass constituting in various forms and combinations the human body being in its growth and function dependent on and regulated by the nervous and vascular systems, themselves cellular, and every derangement of these cells originating in or being attended with a derangement of their nervous and vascular supply, and that supply being powerfully and in quite diverse ways influenced by heat and cold—all morbid conditions of the economy may be influenced materially by the regulated employment of heat and cold, which are entitled therefore to rank as powerful factors in therapeutics.

Hydropathy insists in quite a special way on the necessity of regarding disease first in relation to its cause. It next requires that whatever assistance may be afforded to the *vis medicatrix nature* should in the first place be similar in kind (*i.e.*, should be natural or physiological), rather than alien to it and drawn from sources remote and strange; and, while proceeding on lines which have been common to all medical practice from an early period, it does so by agents hitherto strangely neglected, though not unknown, and effects its purpose in ways less open to objection than those it would displace. For example, when local depletion is required, as of the lung in pneumonia, or the brain in hemorrhagic apoplexy, the final withdrawal from the general circulation of a quantity of blood is deprecated as unnecessary for the attainment of the object in view, and prejudicial in the after period of convalescence. Hydropathy substitutes a diversion to parts indifferent, as the extremities and general cutaneous surface, and so material and sustained as to be much more effectual; while at the same time it holds in reserve the abstracted blood to perform its part in the restoration of strength. Where purgation is employed to derive blood from the brain, liver, or kidneys, a highly sensitive and vital membrane is more or less injured thereby, and convalescence proportionately imperiled. Hydropathy selects the skin as more accessible than the mucous membrane of the alimentary tract, more serviceable also, and less, if at all, susceptible of injury, either temporary or permanent. The skin can with safety be

used for counter-irritation, and is a reservoir of capacity almost unlimited, into which to divert the excess of blood from the brain or other part, while for purposes of excretion it is not inferior to the bowels themselves, and, unlike the latter, is left even more efficient than before. In the febrile state, a reduction of pulse and temperature, and relief from pain and sleeplessness, were commonly attempted, at the period when hydropathy was introduced, by depressants, as antimony, ipecacuanha, and perhaps large doses of alcohol, in combination with sedatives, as opium and chloral. Impaired digestion and depressed vitality were results in some measure inevitable, and always of moment, especially in the more protracted fevers, where recovery becomes a question often of simple physical endurance. By means of the wet sheet pack, cooling compresses, spongings, and allied measures, these ends are attained with comparative ease, certainty, and simplicity, and with entire freedom from objectionable secondary effects.

The agents of hydropathy are at once simple and complex—simple in their elements, and complex in their combinations and modifications. They afford the physician a series of effects almost infinite in variety, both in kind and in degree, both immediate and remote. According as heat and cold are used in their extreme or intermediate degrees, singly or in combination, successively or alternately, momentarily or continuously, dry or moist, and according as the primary action is utilized or the secondary, do their effects differ. The direct or primary effect of cold is to depress, cool, and deplete the part concerned. If its exhibition is brief, reaction (an important factor in hydropathic practice) quickly establishes an opposite condition, stimulating the part, and determining an increased flow of blood to it, with increase of its temperature and vital activity. If it is continuous, the primary depression is maintained, and the revulsive or secondary effect delayed or averted. The direct effect of heat is to increase the amount of blood present; but if the exhibition is brief, and evaporation is permitted, the contrary effect is produced, *viz.*, depression, coolness, and depletion; if it is continuous, the primary effect is preserved. Thus with truth it may be said that cold heats and heat cools, while the converse holds good, and that by simple variations of detail. From the intermediate temperatures (80° to 100°) simple sedative effects are obtained, with absence of secondary or revulsive effects in proportion as the temperature of the part is approximated to. Results vary also according to the heat of the subject. In local inflammations, continuous cold benumbs and contracts, continuous heat soothes and relaxes. Momentary cold excites, heats by reaction, and intensifies inflammation; while momentary heat soothes and ultimately cools the inflamed part by the after evaporation. In the earlier stages and acute varieties of inflammation, therefore, continuous cold or transient hot applications are appropriate, and brief applications of cold in the later, congestive, and chronic forms. But where the local inflammation coexists with general feverishness, continuous cold as the local application is preferable, helping, as it does, to reduce the general exaltation of temperature. In collapse the low general temperature makes heat the best local application. On internal parts the application of heat and cold externally has definite therapeutic effects either identical or opposite (as remarked by John Hunter) through reflex or sympathetic nervous action. Through the vascular system also remote effects are produced, as in heating the lower extremities to derive blood from the brain. The counter relation also of the entire cutaneous surface to the internal organs, as the kidneys

and alimentary mucous membrane, is, in hydropathy, largely utilized for remedial purposes. This sympathy is familiar enough in the etiology of disease, which may be said likewise of all the physiological laws applied to curative purposes in hydropathy.

The appliances and arrangements by means of which heat and cold are brought to bear on the economy are—(a) packings, hot and cold, general and local, sweating and cooling; (b) hot air and steam baths; (c) general baths, of hot water and cold; (d) sitz, spinal, head, and foot baths; (e) bandages (or compresses), wet and dry; also (f) fomentations and poultices, hot and cold, sinapisms, stupes, rubbings, and water potations, hot and cold.

(a.) *Packings*.—The full pack consists of a wet sheet enveloping the body, with a number of dry blankets packed tightly over it, including a mackintosh covering or not. In an hour or less these are removed and a general bath administered. The pack is a derivative, sedative, sudorific, and stimulator of cutaneous excretion. There are numerous modifications of it, notably the cooling pack, where the wrappings are loose and scanty, permitting evaporation, and the application of indefinite duration, the sheet being rewetted as it dries; this is of great value in protracted febrile conditions. There are also local packs, to trunk, limbs, or head separately, which are derivative, soothing, or stimulating, according to circumstance and detail.

(b.) Hot-air baths, the chief of which is the Turkish (properly, the Roman) bath, consisting of two or more chambers ranging in temperature from 120° to 212° or higher, but mainly used at 150° for curative purposes. Exposure is from twenty minutes up to two hours, according to the effect sought, and is followed by a general bath, and occasionally by soaping and shampooing. It is stimulating, derivative, depurative, sudorific, and alterative, powerfully promoting tissue change by increase of the natural waste and repair. It determines the blood to the surface, reducing internal congestions, is a potent diaphoretic, and, through the extremes of heat and cold, is an effective nervous and vascular stimulant and tonic. Morbid growths and secretions, as also the uræmic, gouty and rheumatic diathesis, are beneficially influenced by it. The full pack and Turkish bath have between them usurped the place and bettered the function of the once familiar hot bath. The Russian or steam bath, and the lamp bath are primitive and inferior varieties of the modern Turkish bath, the atmosphere of which cannot be too dry and pure.

(c.) General baths comprise the rain (or needle), spray (or rose), shower, shallow, plunge, douche, wave and common morning sponge baths, with the dripping sheet, and hot and cold spongings, and are combinations, as a rule, of hot and cold water. They are stimulating, tonic, derivative and detergent.

(d.) Local baths comprise the sitz (or sitting), douche (or spouting), spinal, foot and head baths, of hot or cold water, singly or in combination, successive or alternate. The sitz, head and foot baths are used "flowing" on occasion. Rapid alternations of hot and cold water have a powerful effect in vascular stasis and lethargy of the nervous system and absorbents, yielding valuable results in local congestions and chronic inflammations.

(e.) Bandages (or compresses) are of two kinds—*cooling*, of wet material left exposed for evaporation, used in local inflammations and fevers; and *heating*, of the same, covered with waterproof material, used in congestion, external or internal, for short or long periods. Poultices, warm, of bread, linseed, bran, etc., changed but twice in twenty-four hours, are identical in action with the heating bandage, and superior only in the

greater warmth and consequent vital activity their closer application to the skin insures.

(f.) Fomentation and poultices, hot or cold, sinapisms, stupes, rubefacients, irritants, frictions, kneadings, calisthenics, gymnastics, electricity, etc., are adjuncts largely employed in hydropathic practice. Water drinking, while still an important factor in hydropathy, has declined somewhat since the early times of the system.

But that which has from the first distinguished modern hydropathy, and still makes its strict practice a thing apart, is the "crisis," so called. It is related of Priessnitz that, when a boy of fourteen, and treating a sprain, as was the native custom, with wet cloths, he observed an eruption appear beneath them, with the immediate recovery of the part. Gradually the significance and wider application of this eruption dawned upon him, until it came to hold so prominent a place in his practice as to be regarded by many as his greatest discovery.

The eruption coinciding in point of time with recovery as a rule, it was called the crisis, involving doubtless a reference to the term as used by Hippocrates and his successors. But with Priessnitz crisis attained a higher rank, a wider application, and a more definite character. He first showed it to be producible at will under given conditions of the patient, and amenable to direction and control. This eruption, it is claimed, appears only in morbid states of the blood (cachexia) resulting from derangement or defect in the organs of assimilation or excretion or both (*e. g.*, gout, rheumatism), or from the presence of a specific poison (*e. g.*, syphilis). The continuous application to a given tract of skin of the heating bandage or poultice (mediums merely for the exhibition of warmth and moisture) stimulates, in a cumulative way, its vascular and nervous activity, and leads, it may be in a few days or weeks (in some cases hours, in others months), to an eruption, papular, then pustular, and ultimately resolving itself into a suppurating surface commensurate with the area covered by the bandage. There is, in the latter stage, a copious discharge of yellowish-green pus, usually fetid, varied occasionally with patches of brown, blue, or metallic green, and accompanied with itching, sometimes intense. The general temperature is not, as a rule, disturbed; the pulse, except perhaps for the first day or two, falls, if previously quick, to a natural rate; the weight and strength, in the most favorable cases from the outset, and in the rest later on, increase, and it is not uncommon to find the anomaly of a patient exulting in freedom from suffering and a return of the impulses of health simultaneously with the appearance of an extensive inflammation of the skin. The applications, continued without intermission and unaltered (save as cleanliness requires) for weeks or months, according to the nature of the case, are at last no more stained with pus but with serum simply; and finally, still without change of application, the skin will heal, or at most, show a little psoriasis, pityriasis, or eczema, or, it may be, but a faint tinge of red. The bandages are then withdrawn. The original symptoms meanwhile have disappeared with more or less celerity and completeness; and with the eruption has departed the disease that called for it and made it possible. Strength grows apace, no longer taxed by disease or crisis, until recovery in appropriate cases is absolute and secure.

Occasionally the cutaneous inflammation extends in the form of psoriasis, eczema, sudamina, a papular rash or a succession of boils, invading parts untouched by the wet compress. This is called a general crisis; it usually occurs in the last stage of the local one, sometimes after it has ceased, and is advantageous and transient. Debility, whether preëxisting or consequent on the crisis, may call for some modification of its severity and dura-

tion, whether by installments at proper intervals, or curtailment in the later stages, the natural emunctories being relied on to complete the work of purification at greater leisure. A residuum of incurable organic degeneration, as of the kidneys or liver, may likewise put limits to recovery, and provide perpetual material for crisis until the patient is worn out in a vain and ignorant attempt at cure. It was the failure of the earlier hydropathists—through inexperience, default of medical education, or inordinate enthusiasm—to recognize these limitations, that brought crisis into its present discredit and comparative desuetude. Where it is necessary from these or other causes to relieve the patient of the eruption, the substitution of simple ointment, unsalted lard, or other oleaginous or viscid material for the stimulating bandages, or poultices, permits the excitement to subside, and, with occasional exceptions, the skin, in a few days, it may be hours, bears little trace of the eruption.

In the course of hydropathic treatment there occur, though rarely, attacks of diarrhœa, sickness, diuresis, or diaphoresis, which, having been observed frequently to mark the turning point in the history of the case, are held to be varieties of crisis, disturbances attendant on the expulsion of the *materies morbi* from the system.

The theory of crisis may be stated thus: The digestive and assimilative organs are, as is well known, involved, whether primarily or secondarily, in by far the majority of morbid conditions. Their product, the blood, undergoing constant renewal, becomes necessarily more or less impaired—deprived of the blandness that pertains alone to a pure and perfect condition, with what may be termed an inflammatory disposition as the result. The most familiar, because pronounced, forms are the gouty, rheumatic, tubercular, and strumous diatheses. Later the excretory organs, in common with the whole economy, must more or less become deranged, with additions, in consequence, to the sum of morbid elements in the blood, such as uræmic and biliary matters. A vicious circle of action and reaction is established from which escape is difficult, if not impossible, in its more pronounced developments. The digestive disorder begets imperfect and impure blood, and the morbid blood keeps up, and *cæteris paribus* increases, the initial and originating digestive disorder. In all but its most advanced stages ordinary measures, hydropathic or other, may suffice to break this chain, and, by eliminating one or more of its links, render recovery possible, or accomplish it. It is when the complication is beyond their reach that the domain peculiar to crisis begins. The superior vascularity and vitality of the digestive organs—the alimentary tract of mucous membrane, the pancreas, and the liver—is what makes them (in addition to their susceptibility to injury through errors in diet) so commonly the seat of diseased action. The highly nervous and vascular structure of the skin makes easy its elevation to at least an equality in vital activity with the mucous membrane. Warmth and moisture continuously applied to a given portion will, in time, effect this, aided doubtless by maceration and denudation of the cuticle and exposure of the sensitive *cutis vera*. It thus becomes the seat of greatest vital activity; preëminence in morbid activity naturally follows, and a genuine metastasis is effected, such as the natural history of disease is rich in examples of. There is a decline, *pro tanto*, of the primary internal disorder under this combined pressure, first by the diversion of morbid elements, and then by the diversion of an appreciable quantity of the blood itself, and by counter-irritation, when the site of the vicarious inflammation has been selected with that in view. The aid of a sustained derivation to the entire cutaneous surface and the extremities is at the same time secured by means of

the Turkish bath, full packs, and other stimulating agents, while, at the same time, due care is taken to eliminate and negative the original causes of disease. The sum of morbid activity is for the time being increased and intensified; but, in the new location, no longer self-supporting and self-perpetuating, it is sooner or later exhausted. The change in the relation of the *materies morbi* to the digestive system puts an end at one and the same time to the originating and sustaining conditions. The failure of simple counter-irritation (where, as by sinapisms, vesicatories, etc., the irritant is derived from without) to effect the same result in many of the cases afterward cured by crisis negatives of itself the view that the results of the latter are to be attributed to the element in it of counter-irritation alone.

HYDROPHOBIA, from *φοβέω*, water, and *ὕδωρ*, I fear (Syn. *Rabies*, *Lyssa*), an acute infectious disease, occurring chiefly in certain of the lower animals, particularly the canine species, and liable to be communicated by them to other animals, and to man. The main features of the disease are similar alike in the lower animals and men, but that peculiar symptom from which the malady derives its name, viz., the dread of water, appears only to affect the latter. Rabies as it manifests itself in animals belongs to the subject of veterinary medicine; the present notice refers only to hydrophobia occurring in man. The disease has been known from early times, and is alluded to in the works of Aristotle, Xenophon, Plutarch, Virgil, Horace, Ovid, and many others, as well as in those of the early writers on medicine. Celsus gives detailed instructions respecting the treatment of men who have been bitten by rabid dogs, and dwells on the dangers attending such wounds. In later times the investigations of Boerhaave, Van Swieten, John Hunter, Magendie, Breschet, Virchow, Reder, as also of Youatt, Fleming, Meynell, Hertwig, Pasteur, and others, have furnished important information; nevertheless much remains obscure as to the nature and pathology of this formidable disease.

Whatever may be said as to the spontaneous development of rabies in animals—a view which is now generally discredited—there can be no doubt that in man the disease is in every instance the result of the inoculation of the virus contained in the secretions of the mouth of the affected animal into a wound or abrasion of the skin or mucous membrane. In the great majority of cases (90 per cent.) this is due to the bite of a rabid dog, but bites of rabid cats, wolves, foxes, jackals, etc., are occasionally the means of conveying the disease. There is no evidence that the poison can be introduced into the system without an abrasion of the surface. But it must be observed that even of those who have undoubtedly been bitten by rabid animals, only a proportion subsequently suffer from hydrophobia. Thus where the bite has been inflicted on a part of the body protected by clothing, the virus may be wiped from the teeth of the animal before they penetrate the skin. Hence it is found that bites on exposed parts such as the face are very much more dangerous than on other parts which are ordinarily covered. But further, individual susceptibility must be taken into account, for it is undeniable that many persons in whom the virus of rabies has been inoculated escape hydrophobia. John Hunter mentions one remarkable instance in which of twenty-one persons bitten by a rabid dog only one subsequently died from hydrophobia; and a comparison of the best authorities would seem to show that the proportion of those who are attacked with the disease to those who are bitten is less than one-half. Numerous popular fallacies prevail on the subject of hydrophobia. Thus it is supposed that the bite of an angry dog may produce the disease,

and all the more if the animal should subsequently develop symptoms of rabies. The ground for this erroneous notion is the fact, which is unquestionable, that animals in whom rabies is in the stage of incubation, during which there are few if any symptoms, may by their bites convey the disease, though fortunately during this early state they are little disposed to bite. The bite of a non-rabid animal, however enraged, cannot give rise to hydrophobia. Another fallacious notion, not altogether of popular origin, but maintained by a few eminent professional authorities, is to the effect that there is no such disease as hydrophobia at all, but that the symptoms designated by that name are entirely mental phenomena produced by the effect of fear of the consequences following a bite. It might be sufficient as a reply to this to point to the uniform sequence of terrible symptoms which mark the progress of the malady when it has commenced, and to its acute course and invariably fatal termination; but there is the additional fact that very young children, in whom this feeling could scarcely be expected to operate, may suffer and die from hydrophobia.

The period of incubation of the disease, or that time which elapses between the introduction of the virus and the development of the symptoms, appears to vary in a remarkable degree, being in some cases as short as a fortnight, and in others as long as several months or even years. On an average it seems to be from about six weeks to three months. The rare instances of the appearance of hydrophobia many years after the introduction of the poison are always more or less open to question as to subsequent inoculation. During the period of latency, in which the patient seems perfectly well, it is supposed that the poison is undergoing a sort of multiplication, both in the previously wounded part and in the system at large, somewhat analogous to the fermentive process, and that ultimately it comes to tell with deadly effect upon certain portions of the nervous system.

When the disease is about to declare itself it not infrequently happens that the wound, which had quickly and entirely healed after the bite, begins to exhibit evidence of irritation or inflammatory action, or at least to be the seat of morbid sensation such as numbness, tingling, or itching. The symptoms characterizing the premonitory stage are great mental depression and disquietude, together with restlessness and a kind of indefinite fear. There is an unusual tendency to talk, and the articulation is abrupt and rapid. Although in some instances the patients will not acknowledge that they have been previously bitten, and deny it with great obstinacy, yet generally they are well aware of the nature of their malady, and speak despairingly of its consequences. There is in this early stage a certain amount of constitutional disturbance showing itself by feverishness, loss of appetite, sleeplessness, headache, great nervous excitability, respiration of a peculiar sighing or sobbing character, and even occasionally a noticeable aversion to liquids. These symptoms—constituting what is termed the melancholic stage—continue in general for one or two days, when they are succeeded by the stage of excitement in which all the characteristic phenomena of the malady are fully developed. Sometimes the disease first shows itself in this stage, without antecedent symptoms.

The agitation of the sufferer now becomes greatly increased, and the countenance exhibits anxiety and terror. There is noticed a marked embarrassment of the breathing, but the most striking and terrible features of this stage are the effects produced by attempts to swallow fluids. The patient suffers from thirst and desires eagerly to drink, but on making the effort is seized with

a most violent suffocative paroxysm produced by spasm of the muscles of swallowing and breathing, which continues for several seconds, and is succeeded by a feeling of intense alarm and distress. With great caution and determination the attempt is renewed, but only to be followed with a repetition of the seizure, until the unhappy sufferer ceases from sheer dread to try to quench the thirst which torments him. Indeed the very thought of doing so suffices to bring on a choking paroxysm, as does also the sound of the running of water. The patient is extremely sensitive to any kind of external impression; a bright light, a loud noise, a breath of cool air, contact with anyone, are all apt to bring on one of these seizures. But besides these suffocative attacks there also occur general convulsions affecting the whole muscular system of the body, and occasionally a condition of tetanic spasm. These various paroxysms increase in frequency and severity with the advance of the disease, but alternate with intervals of comparative quiet, in which, however, there is intense anxiety and more or less constant difficulty of breathing, accompanied with a peculiar sonorous expiration, which has suggested the notion that the patient barks like a dog. In many instances there is a great mental disturbance, with fits of maniacal excitement, in which he strikes at everyone about him, and accuses them of being the cause of his sufferings—these attacks being succeeded by calm intervals in which he expresses great regret for his violent behavior. During all this stage of the disease the patient is tormented with a viscid secretion accumulating in his mouth, which from dread of swallowing he is constantly spitting about him. There may also be noticed snapping movements of the jaws as if he were attempting to bite, but these are in reality a manifestation of the spasmodic action which affects the muscles generally. There is no great amount of fever, but there is constipation, diminished flow of urine, and often sexual excitement.

After two or three days of suffering of the most terrible description the patient succumbs, death taking place either in a paroxysm of choking, or on the other hand in a tranquil manner from exhaustion, all the symptoms having abated, and the power of swallowing returned before the end. The duration of the disease from the first declaration of the symptoms is generally from three to five days.

M. Louis Pasteur, the great French bacteriologist, has of late years given the subject of hydrophobia and its source, together with the nature of its specific virus, and mode of prevention, his almost undivided attention. The medical world is as yet divided in opinion as to the value of the results and conclusions arrived at by him. But the fact that previous positions taken by this eminent man in relation to other subjects, more or less cognate, have been found in the majority of instances to be correct, should certainly give due weight to his postulates in regard to this as to any other special subject of his investigation.

A brief summary of his investigations presents the following facts for our consideration:—First, that the virus from a rabid animal can be intensified or attenuated by transmission from animal to animal, the concentration or attenuation depending entirely on the species of animal employed as a vehicle. Thus the virus passed through a series of rabbits increases in intensity, while that passed successively from one monkey to another loses its power in a like manner. Second, that the spinal cord of a rabbit which has died of rabies (the cord being the organ most affected by the disease, and generally the part used in making inoculations from one animal to another), when kept in a perfectly dry atmosphere, loses its capability of transmitting rabies in

proportion to the length of time it is kept, until after the fourteenth day of preservation it becomes entirely innocuous. He also lays down as a fact that the virus from a dog's spinal cord injected into the brain of a rabbit will produce rabies in the rabbit in *fourteen* days; the virus from the cord of a rabbit thus treated will, if taken fresh (immediately after the death of the animal) and injected into another rabbit, produce rabies in *seven* days—thus showing greater virulence, being twice as quick as the virus from a dog. But on the other hand, as stated before, if the spinal cord of a rabbit dying from rabies be preserved in dry air it loses its intensity. These facts are the basis of all his experiments. His method of procedure in fortifying the system against hydrophobia is as follows: He takes the spinal cord of a rabbit fourteen days after the death of the animal from rabies, and injects the virus therefrom into the system by hypodermic syringe; then he injects virus from a more recently deceased rabbit (say thirteen days) and so on in descending scale of time from the date of the animal's death, until the subject is able to bear perfectly fresh virus without feeling any inconvenience. It seems that the preceding weaker inoculation renders the succeeding stronger one innocuous. M. Pasteur experimented on forty-two dogs, twenty-three thus protected and nineteen unprotected by inoculation. He then injected fresh virus into all of them, and of the twenty-three protected only one died and that one not from rabies, but from diarrhœa. Of the nineteen unprotected fourteen died from rabies. In July, 1885, he made his first attempt on humanity by inoculating Joseph Meister, a boy who had just been bitten. This boy received twelve injections of virus, M. Pasteur making parallel injections on animals. As he approached the fresher virus a number of the animals (rabbits) died of rabies, but the boy passed the ordeal unharmed and was discharged by M. Pasteur as a successful case. Since that time several hundreds of cases have been treated by Pasteur's method, and only two cases of failure have been reported—one of a patient who was bitten thirty-six days before the treatment began, and the other of several Russians who had been bitten by wolves. It is claimed, however, that wolf virus is more powerful than that of the dog, and this being so, the cases cannot be considered a fair test, especially when the unavoidable delay in treatment is taken into account.

It is important to be able to recognize the symptoms of rabies in a dog, and to this end we would advise that when a dog is observed to change in his manner without apparent adequate cause he had best be looked on with suspicion. Especially if a well-fed dog evince an appetite for unusual articles of diet, such as bits of wood, straw, coal, his own dung and urine, and other morbid substances, he should be confined at once and not be allowed access to any person until at least two weeks have passed. He is generally in the initiatory stage restless, feverish, fond of changing his position of lying down, irritable, and loses his appetite. His entire nature in cases seems to change, obeying his master with reluctance, if at all, and he seems to seek solitude rather than companionship of human friends. Sometimes he starts up, barking furiously at imaginary sounds, snaps at imaginary flies, and exhibits general brain excitement or derangement.

The dangerous stage now supervenes, and the animal will, if unconfined, run at large and bite or snap at any animal or person he meets; if he be confined his rage is sometimes unbounded and he attempts to destroy even inanimate objects. The natural disposition of the dog has, however, something to do with his behavior at this time. Mr. Youatt mentions instances

where a dog did not attempt to bite, but exhibited melancholy rather than rage. Then, after the furious stage has spent itself, the animal dies of exhaustion in from five to twelve days after the beginning of the attack.

The rule of common sense is: if your dog acts suspiciously, confine him where he can do no harm. More especially if he bite anyone, keep him confined till you are sure whether he has or has not the disease. Do not at once kill him and leave the matter forever in doubt to worry the subject of the bite by perhaps groundless fears.

HYDROZOA.—The Hydrozoa form one of the three classes into which the Cœlentera nematophora (distinguished from the Cœlentera porifera, or sponges) have been divided—recognized as such in the article CŒLENTERA, to which the reader is referred. The Hydrozoa correspond to the Linnaean genera Hydra, Tubularia, Sertularia, and Medusa. The name was applied by Huxley in 1856 to a group corresponding to that termed Hydromedusæ by Vogt (1851) and Medusæ by Leuckart (1853), and embracing the forms placed by Gegenbaur in his *Elements of Comparative Anatomy* (1878) in four classes, viz., Hydromedusæ, Calycozoa, Thecomedusæ, and Medusæ. Our knowledge of the structure and life-history of the Hydrozoa, many of which, on account of their delicacy and oceanic habits, are expressly difficult to obtain in a state fit for investigation, has greatly extended within the last five years. While in the two decades preceding this period the admirable researches of Huxley, Gegenbaur, Agassiz, and Allman had brought to light and systematized a vast mass of information with regard to these organisms, the later observations of Claus, the Hertwigs, Haeckel, and Metschnikoff, have corrected, extended, and added to their history, especially in respect of embryological and histological detail.

The *Hydrozoa* present a greater simplicity of ultimate structure than do any animal organisms possessed of as great a complexity of external form. As in all *Metazoa* or *Enterozoa*, the life cycle of a hydrozoon starts with an egg which is at first a single cell or unit of protoplasm, but proceeds after fertilization to multiply by transverse fission in such a way that the resulting cells or units are arranged in two layers, each one cell deep, disposed around a central cavity—the enteron or archenteron. The sac thus formed is known as a diblastula. By the formation of a mouth to the sac, the enteron acquires the functions of a digestive retort in which food matters taken in at the mouth are brought into a chemical condition suitable for the nutrition of the surrounding cells. The two layers of cells (of which the outer only acquires additional layers by the division of the primary cells, and that by no means in all cases) received from Allman the names respectively of the ectoderm and the endoderm, having previously been shown by Huxley (1849) to be the fundamental membranous constituents of which the most varied parts of the more complex *Hydrozoa*—such as tentacles, swimming bells, and air-bladders—are built up in the adult condition. Huxley also pointed out the identity of these membranes with the two primary layers of the vertebrate embryo. The endoderm and the ectoderm, which present themselves, as is now known, in the diblastula (or gastrula) phase of all *Enterozoa*, remain in *Hydrozoa* (and also in the allied groups of *Cœlentera*) as permanently distinguishable elements of structure. This important disposition is associated with and dependent on the simple character which the archenteron or primitive digestive space retains. Into whatever lobes or processes the sac-like body may be, so to speak, molded, whether tentacles or broader expansions,

into these the cavity of the archenteron is extended in the first instance; and where the actual cavity is obliterated the endodermic cell-layer remains to represent it.

Conversely, whatever canals or spaces are discovered in the substance of a hydrozoon (excepting only the cavity of ectodermal otcysts) are simple and direct continuations of the one original enteric cavity of the diblastula, and all such spaces are permanently in free communication with one another.

The whole of the *Hydrozoa* seem to present a lower grade of structure than the *Actinozoa*, in so far as the latter, while retaining permanently free communication between all parts of the archenteric space, yet exhibit a differentiation of this space into an axial and periaxial portion—a digestive tube and a body cavity. The differentiation has only to proceed a step further, namely, to the closure or shutting off of the axial from the periaxial portion of the archenteric space, and we obtain the condition which characterizes the adult forms of the *Cœlomata*, or animals with blood-lymph space distinct from digestive canal. With the attainment of the cœlomite condition, the two fundamental cell-layers, ectoderm and endoderm, which still appear in the embryo, become so far interwoven, and their products so highly differentiated, that it is no longer possible to recognize them as anatomical structures in the adult.

The only deep-seated distinction between *Hydrozoa* and *Anthozoa* (the *Actinozoa* being thus termed when the *Ctenophora* are detached from them) appears to be the particular differentiation of the archenteric space in *Anthozoa* which has just been noted. The diblastula derived from the egg of a hydrozoon, when provided with a mouth, may be spoken of (as are the equivalent forms in other animal groups) as a person. Either this person elongates and develops tentacles in a circlet around or near the mouth, and usually becomes fixed by the aboral pole of the sac-like body, or the sac gradually assumes the form of a clapper-bell or of an umbrella with greatly thickened handle, the mouth being placed at the free end of the handle or of the clapper, and the animal freely swimming by the contractions and expansions of the dome of the bell (disk of the umbrella). The two forms of persons are known—the former as the “hydriform,” the latter as the “medusiform.” The hydriform persons usually occur as fixed branching colonies or trees, produced by lateral budding from an original hydra-form developed from a diblastula.

The hydriform person in its most fully developed state is seen in the colonies of *Tubularia*. In such a colony a number of hydriform persons are united like the flowers of a plant on its branches (whence Allman's terms hydranth, hydrophyton).

The ectoderm or outer cell-layer furnishes the protective and contractile tissues of the hydra-form. Very usually it is not more than one or two cells deep, and is separated from the endoderm by a structureless lamella of firm consistence. In *Hydra* large cells of the ectoderm (neuro-muscular cells of Kleinenberg) bound the external surface and give off horizontal muscular processes which lie side by side on the structureless lamella—forming thus a deep muscular coat, the fibrous elements of which are not independent cells. In larger species some of the fibers may become separated from the tegumentary or superficial cells, and acquire the character of independent nucleated corpuscles (*Hydractinai*, Van Beneden). No nervous elements nor sense-organs occur in any hydra-form (except, perhaps, the *Lucernariæ*). In *Antennularia* some ectoderm cells are amoebiform, and project processes which change shape (nematophors).

The endoderm is usually but one cell deep, and lines

the entire cavity of the body, starting from the margin of the mouth. In the region of the body proper, and in hollow tentacles, the cells are ciliated. In this region they are concerned in the secretion of digestive fluids and in absorption, and sometimes contain colored granules (hepatic?). Allman found in *Myriothela* that the endoderm cells project processes like the pseudopodia of *Protozoa*, and suggests that solid food particles are incepted by them. In the solid tentacles the endodermal cells are greatly modified, forming a kind of skeletal tissue, each cell recalling by its vacuolation and firm cell-wall the characters of vegetable parenchyma. In the stems of *Siphonophora* endoderm cells give origin to muscular processes like those of the ectoderm. This latter fact has a morphological significance which cannot be too gravely estimated.

Generative products are not developed by any hydriform persons (excepting the *Lucernariæ*), the sexual process being carried on by a distinct set of buds developed on the sides of hydriform persons. These buds either become medusiform persons, or are degenerated representatives of such persons (sporosacs). Even the freshwater *Hydra* does not appear to be an exception to this generalization. The single egg-cell of *Hydra* projects at the breeding season in an ectodermal covering, as a wart, from the lower part of the body. A conical eminence or two nearer the mouth contains the spermatozoa. Each ovary and each spermarium represents an aborted generative person. According to Kleinenberg the egg-cell and the sperm-cells are both derived from the ectoderm. The *Lucernariæ* develop internal generative organs which correspond closely with those of the medusiform persons of the group *Scyphomedusæ* (see below), with which they are classified. Both ova and testis are endodermal in origin in *Lucernaria* and in the medusiform persons of the *Scyphomedusæ*, while they appear to be ectodermal in origin in the complete medusiform persons of *Hydromedusæ*, though in the degenerate medusiform persons known as sporosacs they may either or both have an endodermal origin.

The nervous system has only recently been correctly recognized in medusæ, though seen by Agassiz as long ago as 1849, and described both by Fritz Müller and Haeckel in certain forms (*Geryonidæ*) more recently (1860). It differs remarkably in the two great groups into which the *Hydrozoa* are divisible. In the *Scyphomedusæ* there is no continuous nerve-center, but around and about each tentaculocyst nerve-fibers and cells are grouped in such a way as to divide the disk into zones of nerve supply corresponding to the number of tentaculocysts (usually eight). Both the Hertwigs and Eimer entirely missed in their researches the large nerve-fibers and prominent ganglion cells which were discovered by Professor Schäfer of University College, London, in the *Scyphomedusæ*. Professor Claus, of Vienna, has independently described (*Polypen und Quallen der Adria*, 1878) similar nerve-cells and fibers in *Chrysaora* and *Charybdæa*.

The building up of complex individualities, such as a hydrozoon colony, a flowering plant, or a segmented worm or arthropod—in any one of which a number of common units are repeated, but with varied form and function in each part of the compound body—is generally admitted to be explicable in two ways, and which of the two explanations may be adopted in any one case must depend on the ultimate inference from a wide series of observations. The first hypothesis, which undoubtedly applies to the ordinary hydriform colonies of *Hydrozoa*, to the segments of *Tenia*, and to plants formed by the repetition of phyllomes, is that an original unit like those which constitute the composite organism

has freely budded, and repeated its own structure in the well-marked units which remain conjoined to form an aborescent or linear aggregate. This is "eumerogenesis," and such aggregates may be termed eumeristic. By a division of labor and consequent modification of form among the units of a eumeristic aggregate, such an aggregate may (in the course of phylogeny) acquire varied shape and definite grouping of its constituent units, and a high specialization as an individual. The high degree of individuation which may be thus attained is due to the more or less complete synthesis of a eumeristic colony. The more highly individuated Chætopods and Arthropods are synthesized linear colonies. The cyclo-systems of the *Hydrocorallinæ* are undoubted examples of synthesized colonies. The second hypothesis is one which is applicable to cases which, in the absence of special evidence to the contrary, might be regarded as highly synthesized colonies.

HYDRUNTUM. See OTRANTO.

HYÈRES, a town of France, in the department of Var and arrondissement of Toulon, about three miles from the coast of the Mediterranean. It is connected by a branch line with the railway from Toulon to Cannes, and by diligences with the neighboring towns. Population (1890), 9,000.

HYGIENE is the science, PRACTICAL HYGIENE the art, of preserving health. The name has been adopted from the French, from which language it has also been introduced into most other tongues; it is derived from the Greek word meaning health. Writings on health are among the oldest in the world, for the subject has engaged the attention of the profoundest thinkers and most renowned leaders of men. We have only to point to the elaborate directions in the Mosaic laws for the preservation of health through scrupulous attention to cleanliness, the isolation of the sick, and extreme care in the use of wholesome articles of food and drink. Throughout the whole of their history the Jews enjoyed a remarkable immunity from epidemic disease, the most of the instances in which such disease occurred being represented as those in which they departed from the law and doubtless relaxed the wholesome vigilance enjoined by it. In mediæval and modern history they have often, even down to our own time, been spared the ravages of epidemics, when their Christian neighbors were perishing around them. Ignorant superstition often gave rise to the idea that they had poisoned the wells, and they fell victims to the fanaticism of the times. It is highly probable that the periodical cleansing of their dwellings, involved in the thorough search for the leaven which preceded the yearly passover (*Mishna*, Pesachim, i. 11), had a notable influence in preventing that continuous deposition of organic matter, which is no doubt one most powerful factor in the production of zymotic disease. On the other hand the filthy habits of the Christian populations offered a premium to plagues of every kind; for there is no parallel in ancient history to the terrible invasions of disease which from time to time ravaged Europe down to quite recent times.

It is the province of hygiene to seek out and determine the causes of disease, and to formulate rules for their prevention and removal. It may thus be called also preventive medicine, although this term does not quite express all that must be included. The progress of hygiene, such as it was, rested for many ages upon an empirical basis, and indeed to a large extent this is still the case. The subject has, however, in later times at least, been studied to considerable advantage, although much remains to be done. Two centuries ago the mortality of London was 80 per 1,000—at the present day it is under 23. A century ago ships could

barely keep the sea for scurvy, while jails and hospitals were in many cases the hotbeds of fatal disease; now those conditions are rectified, or at least the means of rectifying them are known. Thirty years ago the English troops at home died at the rate of 20 per 1,000—now their death-rate is less than one-half of this. A knowledge of the causes and modes of propagation of disease being necessary in order to provide rules for its prevention, it is obvious that hygiene must be largely dependent upon the advances made in pathology and ætiology; hence the impossibility of any very marked progress in former times, by reason of the imperfection of the collateral sciences, and the want of the appliances more recently made available for inquiries of such a difficult and recondite character. Within this century, however, and especially within the last forty or fifty years, it has been possible to follow out the subject on a more strictly scientific basis, and so to lay a foundation, at least, on which to build a structure, which may one day entitle hygiene to a place among the more exact sciences.

The special subjects which hygiene embraces are the following:—I. Those which concern the surroundings of man; such as meteorological conditions, roughly included under the head of climate; the site or soil on which his dwelling is placed; the character, materials, and arrangements of his dwelling; the air he breathes; the cleansing of his dwelling, and the arrangements for the removal therefrom of the excreta and other effete matters.

II. Those which concern the personal care of health; such as the food he eats and the water and other beverages he drinks; clothing; work and exercise; personal cleanliness; special habits, such as the use of tobacco, narcotics, etc.; control of sexual and other passions.

III. Certain points not directly included in the above; such as the management of infancy; the prevention of disease; the hygiene of the sick-chamber; and the disposal of the dead.

It is obvious that it is impossible to draw any hard and fast line in these divisions, and that they must constantly run into and overlap each other.

1. *Meteorological* or (so-called) *climatic* conditions. Here temperature and humidity are the two points that obviously present themselves for consideration, but it is very difficult indeed to separate their influence from those of soil or site. It is also certain that much that has been attributed to climate is really due to other causes. It may be laid down as a general principle that, if moderate care be taken, man may preserve his health in almost any part of the world, although it must be admitted that in some places, such as hot and moist climates, disease causes appear to be more easily called into action than under colder or drier conditions. Some diseases, such as yellow fever, appear to require a certain temperature for their development and propagation; others, such as enteric (commonly called "typhoid") fever, appear to exist indiscriminately under any meteorological conditions; others, such as cholera, although undoubtedly originating in hot and moist countries, appear capable of being propagated in most parts of the world. In some cases great heat and dryness arrest disease, as used to be observed in Egypt, where the plague was commonly said to cease after St. John's day. During the hot harmattan wind of the west coast of Africa small-pox is arrested, and successful vaccination becomes impossible. To the sick or delicate, meteorological conditions are of great importance, but this part of the subject belongs more to the treatment of disease than to general hygiene. To the healthy, meteorological conditions, however much they may affect personal comfort, are of comparatively little moment as regards health, so long as reasonable care is observed. In a

healthy body an adaptation to circumstances rapidly takes place, and an equilibrium is soon established. Thus, it used to be supposed that great heat increased the temperature of the body, but later observations have shown this to be erroneous, and that the balance is soon reestablished by the process of transpiration; should this, however, be arrested, then a rise of temperature may take place, and disease of a febrile character be established.

2. The *soil* or *site* of the dwelling is, however, of greater moment, and much that has been attributed to climate has been more truly due to locality. Soils are generally divided into moist and dry, permeable and impermeable, and again subdivided according to formation, composition, slope, etc. Healthy soils are those which are dry and permeable, or which have such a slope as renders drainage easy; on the other hand, soils which are flat, moist, and impermeable are generally unhealthy. Soils containing much organic matter are to be avoided, such as alluvial soils generally, as well as all marshy districts. The air in soils is generally more or less impure, hence the unadvisability of occupying dwellings below the ground level or situated immediately on its surface. The water in the soil is a question of great importance, apart from the mere moisture. At varying distances from the surface, but everywhere, there exists a great subterranean lake or sea, known as the *ground-water* or *water-table*, which is constantly in motion, both vertically and horizontally. Its horizontal movement is toward the nearest watercourse or toward the sea; its vertical movement is determined by rainfall chiefly. Much importance has been attached to it, and the following points may be considered as accepted by most hygienists:—(1) A permanently high ground-water, that is, within five feet of the surface, is bad, while a permanently low ground-water, that is, more than fifteen feet from the surface, is good; and (2) violent fluctuations are bad, even with an average low ground-water; a comparatively high ground-water with moderate and slow fluctuations may be healthy. According to the school of Pettenkofer, it is the ground-water which determines the spread of certain forms of disease, such as cholera and enteric fever. A previously high level, succeeded by a fall, with a certain height of temperature in the soil-air, is the condition believed by them to be the one most favorable for disease production. Healthy soils are the granites, metamorphic rocks, clay-slate, limestone, sandstone, chalk, gravel, and sand; unhealthy are—clay, sand, and gravel with clay subsoil, alluvial soil, and marsh-lands, with the exception of peatlands. Among the unhealthy soils ought also to be included all “made” soils, particularly those that are formed so often in towns from rubbish of all sorts. Such soils ought not to be occupied as building sites for at least two years.

3. The sanitation of *dwellings* involves numerous points. The site has been considered in the previous section, but the importance of excluding soil emanations must be insisted upon. The placing of a dwelling in any spot of ground tends to exert an extractive force upon the soil, because the air of the dwelling is almost always warmer than the external air, and there is therefore a constant danger of sucking up the more or less impure soil-air into the dwelling. Not only is this a recognized source of disease, but fatal cases of direct poisoning have sometimes resulted, as when coal-gas has escaped into the soil below or near a dwelling. An impervious foundation is therefore necessary, although this precaution is too often neglected, even in high-class dwellings. Houses ought to be so arranged that they may receive plenty of light, not merely for work or convenience, but as a matter of health. Sunlight, for full health, is as

necessary as air, and this is now so strongly recognized in America that in many of the hospitals in that country rooms are provided where patients may take a “sun-bath.”

The materials of which houses are built are various. Wooden dwellings have advantages, but there is always the danger of fire. Brick or stone is most commonly used, but very good dwellings may be made of concrete or even of mud. Probably the best material is good, sound, well-burnt brick. Dryness must be secured by means of damp-proof courses along the foundations, hollow walls, and cementing or slate-hanging externally. Non-absorbent surfaces internally are important, although some writers, such as Pettenkofer, etc., have been inclined to attribute the unhealthiness of dwellings to the impermeability of the walls obstructing air change. But where air can pass, organic matter can lodge and become a source of danger. It is better, therefore, to have non-absorbent surfaces as much as possible, and to provide for ventilation in other ways. Paint that can be washed is therefore better than paper; if the latter is used it had better be glazed. Care should be taken to scrape off all old papers beneath, as they and the paste used with them tend to decompose and become injurious to health. Ceilings ought to be impervious as well as walls, and floors ought to be made of well-fitting seasoned wood, calked, and oiled or varnished so as to make them water-tight.

Proper cubic space is a matter of great importance, for upon it depends the renewal of air. The air of an air-space can seldom be changed oftener than three times an hour, hence the space ought to be large enough to allow of such rate of change providing enough of air for respiratory purposes. The furniture of rooms, especially sleeping-rooms, ought not to be too massive; while curtains and hangings too often form traps for dust and organic matter.

The warming of houses is important, and is generally badly and wastefully done. The open fireplace has great advantages, but it is in many cases insufficient. Where any general system is employed it is better to warm the air in the room itself, as by pipes conveying hot water or steam, than to warm it before delivery. Overheated rooms are a source of ill-health. For sitting-rooms 60° to 65° is quite enough; for a study or work-room 60° is sufficient, even in some cases less than this. A sleeping-room need never be above 60°, often with advantage below it. Fresh air ought not to be sacrificed to temperature, except under extreme circumstances. Dwellings should not be occupied for some time after building, till they are thoroughly dry. Rheumatism, chest diseases, etc., are very apt to arise from neglect of this precaution.

Scrupulous attention to cleanliness is necessary in dwellings, and there is wisdom in their periodical vacation for a certain time, so as to let them lie fallow, as it were, and interrupt the continuity of deposit of organic matter. Dwellings ought to be scattered over as wide an area as possible, for statistics show that sickness and death-rate are often inversely proportioned to the amount of area per head occupied by a community. The area per head in London is estimated at double that of Paris and many other cities, while at the same time its death-rate is smaller than that of any other large city in Europe.

4. *Air* is the prime necessity of life. Food or water may be abstained from for a considerable time, and we may thus have an opportunity of replacing either should we doubt its purity or wholesomeness, but the atmosphere around us we must breathe or die. Hence the paramount necessity for having it pure. But, although this is apparently so obvious, attention to its impor-

tance has been very generally omitted. Air consists of a mechanical mixture of oxygen and nitrogen, in the proportion of nearly 21 per cent. of the former to 79 of the latter, with small quantities in addition of carbonic acid, moisture, organic matter, etc. By respiration and combustion air becomes vitiated, the oxygen diminishing and the carbonic acid and organic and suspended matter increasing. Within certain limits the amount of carbonic acid is in itself immaterial to health, but it is important as a measure of the amount of organic matter, which is really the dangerous impurity. Air vitiated by respiration is also much more dangerous than when the carbonic acid is partly the result of combustion. It is now pretty generally admitted that air cannot be considered as really good and fit for respiration in which the respiratory impurity reckoned as carbonic acid much exceeds two parts in 10,000 by volume. On the other hand, if air can be kept down to this point, the condition may be looked upon as satisfactory. The amount of impurity given off by living beings varies of course with size, weight, age, sex and work, but it may be allowed that under ordinary circumstances it amounts to about six cubic feet of carbonic acid per head in ten hours during repose. This requires an hourly supply per head of 3,000 cubic feet of fresh air for its dilution, and this amount should be largely increased during work or in sickness (see HOSPITAL). The diseases which have been shown to arise from the effects of vitiated air are widely prevalent, including such as consumption and other forms of scrofulous disorders, bronchitis and pneumonia, sore throat, etc. Crowded and ill-ventilated places also tend to increase the virulence and the rapidity of spread of the various communicable diseases.

5. *Cleansing*, including the removal of slops, excreta, etc., forms one of the most important and also most difficult of questions. The main principle is that all should be immediately and effectually removed from the house and its neighborhood, and that there should be no possibility of reflux of foul air from drain or cesspool. The system of water-carriage is certainly the cleanest and most convenient, especially among large communities, but other systems find advocates. In villages and isolated houses the earth system and other dry methods have many advantages. The question of the disposal of sewage is a very large one, into which it is impossible to enter here. Hitherto all or almost all the material has been wasted by being poured into rivers or the sea, the streams being thus polluted and the shores rendered offensive. The object to be aimed at is to utilize a product of undoubted fertilizing influence, without endangering the health of the community. The diseases to be apprehended from imperfect methods of sewage removal are enteric fever, cholera, diphtheria, sore throat, and an aggravation of most other diseases, especially those of an eruptive character. Ashpits ought to be especially attended to, their neglect being attended with much danger.

6. *Water supply*, although included under the head of food and beverages, merits special consideration, so important is its relation to health, both directly as a drink and indirectly with reference to its many other uses. It is required for drinking, cooking, the cleansing of person, clothes and dwelling, and the flushing of closets, sewers and drains. The hygienic requirements are that water should be good in quality and sufficient in quantity. Good water should be clear, colorless, quite free from suspended matter, of a good luster, and should have a pleasant sparkling taste, the latter qualities being due to the carbonic acid and atmospheric air dissolved in it. In its chemical composition it ought to be as free as possible from organic matter.

The evidence in favor of communication of disease by means of drinking water is now very extensive, and we may cite diarrhoea, dysentery, ague, enteric fever and cholera as among the diseases which may be conveyed through this channel. Numerous parasites also find their way into the human body by this means. Hard water is objectionable for cooking and washing, nor can it be recommended for drinking, although some insist upon a certain amount of hardness being essential. In the case of water being impure, boiling, distilling or filtering may be resorted to. The two former are the most efficacious, but the last has advantages of convenience if properly carried out. Charcoal filters, if properly cleansed or renewed sufficiently often, are useful; but it is better to have a material that purifies without risking any deterioration of the water itself. Such filters as the spongy iron and the earthen effect this. All filters, however, require the medium to be cleansed or renewed periodically. In a house the chief dangers are from dirty cisterns and from pipes being connected with drains and closets. All supply should be on the constant system, and no pipe supplying a closet should be resorted to for drinking purposes. All overflow pipes should deliver in the open air. The quantity of water required per head may be stated at a minimum of twelve to sixteen gallons per diem where there is no general system of drainage, and about twenty-five gallons with drainage. In towns more than this is necessary, and from thirty to fifty gallons are desirable. In sickness generally double the amount is necessary that is required in health. The source of the water ought to be pure—springs, deep wells and upland surface water being the best. Shallow wells and rivers to which sewage gains access are most to be avoided.

7. For *food and beverages* the reader is referred to the article DIETETICS.

8. *Work and Exercise*.—The kinds of work performed by man are, of course, very various, but they may be reduced more or less to a uniform standard, which is usually reckoned as so many tons (or pounds) raised through one foot, or, tersely, as foot-tons or ton-feet. A fair day's work is generally taken at 300 foot-tons, a laborious day's work at 450, and the maximum to be expected, except under very special conditions, at 600. For this work a certain time should be allowed, as the strain increases (almost in a geometrical ratio) with the velocity. Usually speaking, fifty foot-tons an hour is a fair amount, and this ratio is equal to a walk of three miles for an average man. The amount for mental work has not been accurately calculated, but it may be safely assumed that a man of sedentary occupation ought to take exercise of a physical kind varying from 50 to 100 foot-tons per diem. In all cases his food ought to be proportioned to his work, for it is now recognized that man is a machine, whose work depends upon the energy derived from the food he eats.

9. *Clothing and Personal Cleanliness*.—Clothing should fulfill the functions of preserving warmth in cold weather, providing covering without being too oppressive in hot weather, keeping out wet in wet weather, and yet allowing sufficient transpiration for health. At the same time it ought to admit of frequent change and cleansing. Doctor Parkes has pointed out that it is probably due in some measure to cleaner habits with reference to clothing that the diminution of typhus fever should have been so marked in recent times. Personal cleanliness is also a matter of great importance, a daily general bath being advisable for everyone. For animals as well as human beings it has been shown that cleanliness is conducive to improved appetite and general health. Filth is one of the prime factors in the

production and propagation of most of the devastating plagues known to mankind.

10. *Prevention of Disease.*—This is a large question, on which we can only briefly touch. Much depends upon our knowledge of etiology or the remote causes of disease. The best rule for preventing disease is to follow out carefully the principles of general hygiene, laid down with reference to pure air, pure water, proper food, cleanliness, etc. Some diseases may be more specially provided against, such as paroxysmal fevers by the use of quinine, and small-pox by vaccination, but for the great majority of diseases no such special preventive is known. Some diseases, such as typhus fever and plague, are successfully combated by scattering the population over a large area and inducing the freest ventilation, and to all diseases this plan may be applied with more or less effect. In those diseases which are known to be communicable, such as scarlet fever, isolation of the patients is an effectual means of arresting the spread; but the poisons of others, such as measles and hooping-cough, are so subtle that isolation can only be looked upon as a measure of doubtful success. Much stress has been laid upon *disinfection* as a means of preventing disease, and if properly carried out it has some efficacy. But it is a mistake to place too implicit reliance upon it as ordinarily practiced. In dealing with clothing, bedding, etc., the best method is the application of heat, at or above the boiling-point of water, which may be done by means of dry heat, superheated steam, or boiling water. In fumigating places, burning sulphur or the vapor of chlorine or nitrous acid is used, but to be effectual the air must be rendered for the time irrespirable. The solid and liquid disinfectants (so-called) are chloride of lime, the permanganates, carbolic acid, and a great many similar substances, many of which have been made the subjects of patents. A large number of them are merely deodorants. It may be stated generally that disinfectants are useful as adjuncts to other hygienic measures, but that they cannot replace them, except to a small extent, and in a very imperfect way.

11. *Disposal of the Dead.*—The most frequent plan is interment in the earth, but it may well be a question if this be the best plan; it has certainly led to much evil when carried out near habitations. Two other plans have been suggested, viz., burial at sea (suggested by the late Doctor Parkes) and cremation. The former is hardly likely to be resorted to, but the latter would be effectual in preventing the evil consequences of ordinary interment. At the same time the danger that it might too effectually conceal much secret crime has to be taken into account.

HYGINUS, CAIUS JULIUS, a native of Spain, and the freedman of Augustus, by whom he was made chief of the Palatine library. He is said to have fallen into great poverty in his old age, and to have been supported by one C. Licinius. He was a voluminous author, and his works included topographical and biographical treatises, commentaries on Cinna and on Virgil, and disquisitions on agriculture, bee-keeping, and the military art. All of these are lost. But there have come down under his name two school treatises on mythology, which have produced much discussion.

HYGINUS (surnamed GROMATICUS, from *gruma*, a surveyor's measuring rod), a writer on land surveying and castrametation, who flourished in the reign of Trajan, (98–117 A.D.)

HYGROMETRY. A large number of substances, such as sugar, flour, and bread, possess the property of absorbing moisture, and most gases, as well as air, absorb and retain aqueous vapor. The term *hygrometry* is employed to signify the measurement of the degree of dampness of substances, and to denote the processes

by which their humidity is ascertained. The term, however, may be considered as restricted to the humidity of the atmosphere, owing to the paramount importance of that branch of the subject, and the slight and unsatisfactory knowledge we yet possess of the laws of hygrometry of other substances.

All organic substances contain pores for the conveyance of their juices, and are influenced by the accession of moisture, some of them very markedly so. Every species of wood is liable to these hygrometric changes, the amount of contraction and expansion being much greater across the grain of the wood than lengthways. Hence the panels of doors are fitted into grooves so as to allow of shrinkage, for, if secured at the edges, the panels must inevitably split. The hair of animals is also eminently hygrometric, curling and uncurling as the air becomes drier or moister, and it is because of the peculiar sensations accompanying these hygrometric changes that the cries and behavior of many of the lower animals furnish valuable prognostications of weather changes. Similarly many manufactured objects, such as paper, cordage, etc., vary in weight, bulk, form, and elasticity with the varying degrees of humidity of the air, and other interesting prognostics have been drawn from these hygrometric changes.

In the earlier stages of the investigation of the hygrometry of the air, the hygrometric properties of several substances were made use of as instruments of observation. Of these may be named the twisted Indian grass (*Oobeeena Hooloo*), employed by Captain Kater on account of its remarkable property of twisting and untwisting according to the dampness of the air; a slip of whalebone cut across the fibers, used by De Luc; and the hygrometer of Saussure, which was formed of a hair from which the oily matter had been previously removed, and which stretches when moist and contracts when dry. Experience has, however, shown that none of these hygrometers are satisfactory instruments, since they give inconsistent results, and are liable when in use to great and uncertain changes. Hence, while they serve to give the roughest idea of the state of the air as regards moisture, they have fallen into disuse as accurate instruments of observation of the hygrometry of the atmosphere. But in the intensely cold climates of Russia and Siberia, the hair hygrometer still continues to be used as an instrument of observation; and when we consider the tediousness and difficulty of making hygrometric observations with the hygrometer in most general use when the temperature of the air descends below the freezing point of water, the hair hygrometer should perhaps be considered as good an instrument as is available to put into the hands of ordinary observers in times of low temperature.

The most accurate hygrometers are those which are constructed, not as the above, on the principle of absorption of vapor, but on the principles of condensation or evaporation. The well-known fact that the temperature of a wet body is lower than that of a dry one when under the same atmospheric conditions was applied by Sir John Leslie to measure the humidity of the air. Leslie's hygrometer, which is an adaptation of his differential thermometer, is formed by uniting two tubes having a ball blown on the end of each, into which some colored sulphuric ether has been previously introduced. When both bulbs are at the same temperature, the fluid stands at the zero of the scale, but when one of them is covered with wetted paper or muslin the instrument shows the depression of temperature of the wetted bulb. In order to ascertain the quantity of moisture corresponding to the reading of a Leslie's hygrometer, we must deduct from the total quantity of

moisture which the air of the temperature at the time of observation is capable of holding the deficiency due to the degree of cooling shown by the hygrometer.

As no air is ever absolutely dry, but contains more or less moisture, it is evident that if any mass of air be cooled sufficiently it may be made to deposit its moisture. A familiar example of the condensation of vapor is seen in the formation of dew on a tumbler filled with cold water and brought into a warm room. This dew is caused by the deposition of moisture from the air in contact with the cold surface of the glass, which is cooled down below the point of saturation. The temperature of the glass at the instant dew begins to form on its surface is termed the dew-point, which corresponds with the point of saturation of the air.

Daniell's hygrometer consists of a glass tube bent at right angles at two points with a bulb at each extremity, one bulb being of black and the other of clear glass, the latter covered with muslin. The liquid within the bulbs is ether, which at the time of being sealed is made to boil for the purpose of expelling the air. If the temperature of the two bulbs be made to differ from each other, all the ether is transferred from the warmer to the colder bulb. In making an observation the whole of the ether is first transferred to the black bulb, and ether is then dropped on the muslin covering outside the clear bulb. This ether quickly evaporates, and in doing so rapidly lowers the temperature of the clear bulb so that the ether inside the black bulb distils over into the clear bulb. The result is a lowering of the temperature of the black bulb, and, as soon as this falls to the temperature of the dew-point of the air where the experiment is conducted, a ring of vapor begins to be formed outside the black bulb, more or less dulling its surface. At this instant a thermometer placed inside the tube with its bulb immersed in the ether filling the black bulb is read, and the reading gives the dew-point of the air at the time.

Regnault's hygrometer is a little more complicated than Daniell's, but its indications are much more trustworthy. It consists of a glass tube or capsule having on the bottom and a little way up a highly polished silver surface, and closed by a cork with two holes. Through one of these holes the stem of a thermometer passes, having its bulb at the bottom of the silvered capsule, while through the other hole passes a narrow metallic tube, one end of which opens close to the bottom of the capsule, and the other end may, if desired, be connected with an aspirator or air-pump. In making an observation as much ether is introduced into the capsule as will cover the bulb of the thermometer, and then by transmitting air through the tube the ether vapor is withdrawn from the capsule through another tube. By this means the temperature of the ether is very rapidly reduced, and since the whole mass of the ether is agitated by the air-bubbles which rise through it from the bottom of the capsule, the cooling of the ether is equal throughout. The thermometer is then read quickly, but to insure an accuracy to the tenth of a degree a second and a third experiment, conducted more slowly, should be made. As showing the rapidity with which observations can be made with this hygrometer, Henry F. Blanford on one occasion made six observations in six minutes in the dry climate of Secunderabad, when the temperature of the air was 93° , the dew-point 51° , and the relative humidity consequently 24° . The temperature of the air at the time of observation may be ascertained in the usual way, or by means of the thermometer if care be taken that its temperature is unaffected by the proximity of the person of the observer.

Owing to the expense and great trouble attending the use of hygrometers which give the dew-point directly

by condensation, another hygrometer has come into extensive use by which the dew-point is determined indirectly by evaporation. This is August's hygrometer, sometimes called Mason's hygrometer, but more generally known as the dry and wet bulb hygrometer, which has the strong recommendation of being self-acting, and requiring only the readings of the two thermometers in making air observations.

HYMEN, or HYMENÆUS, was originally the name of the song sung at marriages among the Greeks. As usual the name gradually produced the idea of an actual person whose adventures gave rise to the custom of this song. He occurs often in association with Linus and Ialemus, who represent similar personifications, and is generally called a son of Apollo and a Muse. In Attic legend he was a beautiful youth who, being in love with a girl, followed her in a procession to Eleusis disguised as a woman, and saved the whole band from pirates. As reward he obtained the girl in marriage, and his happy married life caused him ever afterward to be invoked in marriage songs. At other times the tale is of an opposite character; Hymen was unfortunate either by dying on his marriage day or in some other way, and he was invoked to propitiate him and avert a similar fate. He occurs often in the train of Aphrodite, along with Eros, Himerus, Pothus, etc.

HYMENOPTERA, an order of *Insecta* (so named from their wings being joined), containing the insects commonly called bees, wasps, ants, ichneumons, gall-flies, saw-flies, and others less known which have received no English names. The main characteristics of the order are these: The possession of four wings, of which the anterior are always larger than the posterior, always of the same texture, and mostly with nervures arranged in regular patterns; a dense, hard skin, smooth, shining, or very hairy; a mouth always provided with mandibles adapted for biting, though the other mouth parts may be so modified as to serve for mastication, or for the sucking, or rather lapping, of liquids. The female is provided with an anal instrument connected with oviposition, and sometimes serving for defense, in which case it is in communication with a poison gland. They undergo a regular transformation, and have larvæ provided with legs on the thorax and abdomen, or on the former part only, or (as is more often the case) entirely footless.

Hymenopterous insects procreate by the union of the two sexes. This takes place usually in the sunshine. Sometimes the connection does not last more than a few seconds, and is not preceded by any preliminary courting. On the other hand many bees remain united for hours, and the genital parts of the male get torn and ruptured, so that it dies immediately after. Some species of *Chalcididae* have been observed coquetting together for more than an hour before uniting. Generally copulation takes place on the ground; but a few forms pair on the wing. The male *Anthophora*, for instance, carries the female with him into the air for the marriage flight. This is the reason why the male *Anthophora* is larger than the female, instead of being smaller, as is usually the case.

While, as has been said, *Hymenoptera* reproduce by the union of the two sexes, yet parthenogenesis or virgin reproduction is of not uncommon occurrence, and has been observed in all the families whose development for more than one generation can be traced with sufficient facility and accuracy. We meet with this phenomenon under (broadly speaking) two or three phases. Many females, if they cannot get access to males, will readily lay eggs, which are fertile and give issue to larvæ; but these larvæ, when they reach maturity, yield invariably males. Anyone can test this for him-

self with the too common gooseberry grub, *Nematus ribesii*. The same thing occurs with wasps, ants, and bees. With saw-flies, again, there are some species whose males are quite unknown, although the species have been caught and bred from the larvæ in hundreds, e.g., *Eriocampa ovata*. Others have males, but they are extremely rare, e.g., *Nematus gallicola*. It has been shown, too, that the species just mentioned and some others (*Phyllotoma nemorata*, *Pæcilosoma pulveratum*, etc.) with males unknown readily lay fertile eggs. The queen bee can lay eggs which will produce males or females, by opening or closing the spermatic sac, and letting the eggs come in contact or not with the spermatic fluid. In the former case females will be the result, in the latter males. Worker bees, wasps and ants deposit eggs which produce, however, only males. A still more curious phenomenon in connection with the reproduction of some gall-insects (*Cynipidæ*) requires to be mentioned. In early spring will be found on oak leaves and flowers soft, juicy, greenish, globular pea-shaped galls. Out of these come in summer the gall-flies represented by both sexes. In the autumn (also on oak leaves) are found those curious flat, brownish galls commonly called "oak spangles," which by many are taken for fungi, and have indeed been described as such. These "spangle galls" retain very much the same form during the autumn and winter; then in March they swell up and become juicy, and a larva makes its appearance; this soon becomes a pupa and finally a fly, but only in one sex, the female. It was long supposed that these two insects had no relationship with each other, that they belonged in fact to two distinct genera, for not only did the galls differ, but the insects themselves differed in the form of the body, the wings, etc. But it has recently been shown by Doctor Adler that the two are forms of the same species, that there is an alternation of a spring bisexual form, with an autumnal unisexual one.

A dimorphism of another kind exists among the social bees, wasps, and ants. An ordinary colony of these insects consists of three sorts of individuals. There is the large female which founded the colony; then there are the workers or neuters, undeveloped females on whom the work of the colony depends; and lastly, there are the males. It is with ants that the workers are most profoundly modified. They are wingless, and there may be in a colony several sorts, each kind performing different duties, and having the body modified in accordance with the work it has to do. Those which act as soldiers (when a special kind is set apart for this work), for instance, have the mandibles enormously developed; another set may secrete honey for the benefit of the others, etc.

The *Hymenoptera* must be regarded as one of the most beneficial and useful to man of the insect orders. The produce of the hive-bee—wax and honey—has been employed by man since the earliest ages, and forms an extensive article of commerce. The curious structures raised by *Cynipidæ* on the oaks of eastern Europe—galls—have long been used in the manufacture of ink. But, whatever the bee may have done in contributing to our luxuries, and the gall-fly in rendering easier the advance of knowledge, these are small benefits compared to the indirect advantages we derive from the labors of the parasitic species through the havoc they make among the insects which devour the produce of our fields and gardens, and too often destroy the labors of the farmer and gardener. When we remember that there are vast numbers of insects which destroy plants; that many of these are so minute and obscure in their mode of life as to escape ordinary observation, save when the injury is done; and that others appear in enormous numbers,

it becomes evident that an insect which causes the death of a single caterpillar does good service, since that caterpillar would have (if left undisturbed) given, in all probability, origin to an imago which might give birth to hundreds of others. It is this which the ichneumons do—they destroy the larvæ of plant-devouring insects. Another division of *Hymenoptera* does equally good service. It has been shown by modern researches that without the aid of bees many flowers would never yield seed. Many plants cannot fertilize themselves, so that if bees did not carry the pollen from one plant to another, and thus effect fertilization, no seed would be produced. The red clover, for instance, would never produce seed if it were not for the humble bees fertilizing it in their visits in search of honey. It must, however, be confessed that some *Hymenoptera* do very considerable damage to vegetation, especially saw-flies and ants.

The *Hymenoptera* are almost exclusively dwellers on land, and are essentially sun-loving insects. Two or three only live an aquatic or quasi-aquatic mode of life.

Many *Hymenoptera* give origin to sounds. The humming of bees is one of the most familiar and delightful of country sounds. It is not yet quite clearly understood how it is caused, but there is evidence enough to show that the buzzing originates by the air impinging against the lips of the metathoracic and abdominal stigmas; although it is possible, too, that the rapid vibration of the wings (224 per second with the *Bombus muscorum* and 440 with the honey bee) may also have something to do with the production of sound, for a bee can give out differently pitched notes according to its mood, as it is pleased or angry. Besides the buzzing sounds, a few other species chirp by means of the abdominal segments.

HYMETTUS, a mountain (3368 feet) in Attica, now called Trelo Vouni, situated to the southeast of Athens, was famous among the ancients for its honey and its bluish marble. The honey is still in repute.

HYMNS. The word "hymn" was employed by the ancient Greeks to signify a song or poem composed in honor of gods, heroes, or famous men, or to be recited on some joyful, mournful, or solemn occasion. Polymnia was the name of their lyric muse. Hellenic hymns, according to this conception of them, have come down to us, some from a very early and others from a late period of Greek classical literature. Those which passed by the name of Homer were already old in the time of Thucydides. They are mythological poems (several of them long), in hexameter verse—some very interesting. The Romans did not adopt the word "hymn;" nor have we many Latin poems of the classical age to which it can properly be applied. For the origin and idea of Christian hymnody we must look, not to Gentile, but to Hebrew sources. St. Augustine's definition of a hymn, generally accepted by Christian antiquity, may be summed up in the words, "praise to God with song." Bede understood the "canticum" as properly requiring meter; though he thought that what in its original language was a true hymn might retain that character in an unmetrical translation. Modern use has enlarged the definition: Roman Catholic writers extend it to the praises of saints; and the word now comprehends rhythmical prose as well as verse, and prayer and spiritual meditation as well as praise.

The modern distinction between psalms and hymns is arbitrary (see PSALMS). The former word was used by the LXX. as a generic designation, probably because it implied an accompaniment by the psaltery (said by Eusebius to have been of very ancient use in the East) or other instruments. The cognate verb "psallere" has been constantly applied to hymns, both in the Eastern

and in the Western Church; and the same compositions which they described generically as "psalms" were also called by the LXX. "odes" (*i.e.*, songs) and "hymns."

In the New Testament we find our Lord and His apostles singing a hymn, after the institution of the Lord's Supper; St. Paul and Silas doing the same in their prison at Philippi; St. James recommending psalm-singing, and St. Paul "psalms and hymns and spiritual songs." St. Paul also, in the fourteenth chapter of the first epistle to the Corinthians, speaks of singing, and of every man's psalm, in a context which plainly has reference to the assemblies of the Corinthian Christians for common worship. All the words thus used were applied by the LXX. to the Davidical psalms; it is therefore possible that these only may be intended, in the different places to which we have referred. But there are in St. Paul's epistles several passages which have so much of the form and character of later Oriental hymnody as to have been supposed by Michaelis and others to be extracts from original hymns of the Apostolic age. Two of them are apparently introduced as quotations, though not found elsewhere in the Scriptures. A third has not only rhythm, but rhyme. The thanksgiving prayer of the assembled disciples, recorded in Acts iv., is both in substance and in manner poetical; and in the canticles, "Magnificat," "Benedictus," etc., which manifestly followed the form and style of Hebrew poetry, hymns or songs, proper for liturgical use, have always been recognized by the church.

The hymn of our Lord, the precepts of the apostles, the angelic song at the nativity, and "Benedicite omnia opera," are referred to in a curious metrical prologue to the hymnary of the Mozarabic Breviary, as precedents for the practice of the Western Church. In this respect, however, the Western Church followed the Eastern, in which hymnody prevailed from the earliest times.

The early mediæval period, from the time of Gregory the Great to that of Hildebrand, was far from deficient in the production of good hymns, wherever learning flourished. Bede in England, and Paul "the Deacon"—the author of a fairly classical sapphic ode on St. John the Baptist—in Italy, were successful followers of the Ambrosian and Gregorian styles.

Another celebrated hymn, which belongs to the first mediæval period, is the "Veni Creator Spiritus" ("Come, Holy Ghost, our souls inspire"). The earliest recorded occasion of its use is that of a translation (898) of the relics of St. Marcellus, mentioned in the *Annals* of the Benedictine order. It has since been constantly sung throughout Western Christendom (as versions of it still are in the Church of England), as part of the appointed offices for the coronation of kings, the consecration and ordination of bishops and priests, the assembling of synods, and other great ecclesiastical solemnities.

The invention of "sequences" by Notker may be regarded as the beginning of the later mediæval epoch of Latin hymnody. In the eucharistic service, in which (as has been stated) hymns were not generally used, it had been the practice, except at certain seasons, to sing "laud," or "Alleluia," between the epistle and the gospel, and to fill up what would otherwise have been a long pause, by extending the cadence upon the two final vowels of the "Alleluia" into a protracted strain of music. It occurred to Notker that, while preserving the spirit of that part of the service, the monotony of the interval might be relieved by introducing at that point a chant of praise specially composed for the purpose.

The "Golden Sequence," "Veni, sancte Spiritus"

("Holy Spirit, Lord of Light"), is an early example of the transition of sequences from a simply rhythmical to a metrical form.

But the two most widely celebrated of all this class of compositions—works which have exercised the talents of the greatest musical composers, and of innumerable translators in almost all languages—are the "Dies Iræ" ("That day of wrath, that dreadful day"), by Thomas de Celano, the companion and biographer of St. Francis of Assisi (who died in 1226), and the "Stabat Mater dolorosa" ("By the cross sad vigil keeping") of Jacopone or Jacobus de Benedictis, a Franciscan humorist and reformer, who was persecuted by Pope Boniface VIII. for his satires on the prelacy of the time, and died very old in 1306.

There were other distinguished Latin hymn-writers of the latter mediæval period besides those already mentioned. The name of St. Bernard of Clairvaux cannot be passed over with the mere mention of the fact that he was the author of some metrical sequences. He was, in truth, the father, in Latin hymnody, of that warm and passionate form of devotion which some may consider to apply too freely to divine objects the language of human affection, but which has, nevertheless, been popular with many devout persons, in Protestant as well as Roman Catholic churches. Spee, "Angelus," Madame Guyon, Bishop Ken, Count Zinzendorf, and Frederick William Faber may be regarded as disciples in this school. Many hymns, in various languages, have been founded upon St. Bernard's "Jesu dulcis memoria" ("Jesu, the very thought of Thee"), "Jesu dulcedo cordium" ("Jesu, Thou joy of loving hearts"), and "Jesu Rex admirabilis" ("O Jesu, King most wonderful")—three portions of one poem, nearly 200 lines long.

Luther was a proficient in and a lover of music. He desired (as he says in the preface to his hymn-book of 1545) that this "beautiful ornament" might "in a right manner serve the great Creator and His Christian people." The persecuted Bohemian or Hussite Church, then settled on the borders of Moravia under the name of "United Brethren" (which their descendants still retain), had sent to him, on a mission in 1522, Michael Weiss, who not long afterward published a number of German translations from old Bohemian hymns (known as those of the "Bohemian Brethren"), with some of his own. These Luther highly approved and recommended. He himself, in 1522, published a small volume of 8 hymns, which was enlarged to 63 in 1527, and to 125 in 1545. He had formed what he called a "house choir" of musical friends, to select such old and popular tunes (whether secular or ecclesiastical) as might be found suitable, and to compose new melodies, for church use. His fellow laborers in this field (besides Weiss) were Justus Jonas, his own especial colleague; Paul Eber, the disciple and friend of Melancthon; John Walther, choirmaster successively to several German princes, and professor of arts, etc., at Wittenberg; Nicholas Decius, who from a monk became a Protestant teacher in Brunswick, and translated the "Gloria in Excelsis," etc.; and Paul Speratus, chaplain to Duke Albert of Prussia in 1525. Some of their works are still popular in Germany.

Luther's own hymns, thirty-seven in number (of which about twelve are translations or adaptations from Latin originals), are for the principal Christian seasons; on the sacraments, the church, grace, death, etc.; and paraphrases of seven psalms, of a passage in Isaiah, and of the Lord's Prayer, Ten Commandments, Creed, Litany, and "Te Deum." There is also a very touching and stirring song on the martyrdom of two youths by fire at Brussels, in 1523-24. Homely and some-

times rugged in form, and for the most part objective in tone, they are full of fire, manly simplicity, and strong faith. Three rise above the rest. One for Christmas, "From Heaven above to earth I come," has a reverent tenderness, the influence of which may be traced in many later productions on the same subject. That on salvation through Christ, of a didactic character, "Dear Christian people, now rejoice," is said to have made many conversions, and to have been once taken up by a large congregation to silence a Roman Catholic preacher in the cathedral of Frankfort. Pre-eminent above all is the celebrated paraphrase of the forty-sixth Psalm: "A sure stronghold our God is He," "the production" (as Ranke says) "of the moment in which Luther, engaged in a conflict with a world of foes, sought strength in the consciousness that he was defending a divine cause which could never perish." Carlyle compares it to "a sound of Alpine avalanches, or the first murmur of earthquakes." Heine called it "the Marseillaise of the Reformation."

The principal hymn-writers of the Lutheran school, in the latter part of the sixteenth century, were Selnecker, Nicholas Hermann, and Hans Sachs, the shoemaker of Nuremberg, also known in other branches of literature. All these wrote some good hymns.

Toward the end of the seventeenth century, a new religious school arose, to which the name of "Pietists" was given, and of which Philip Jacob Spener was esteemed the founder. He and his pupils and successors, August Hermann Francke and Anastasius Freylinghausen, all wrote hymns. Spener's hymns are not remarkable, and Francke's are not numerous.

After the Reformation, the development of hymnody was retarded, in both parts of Great Britain, by the example and influence of Geneva. Archbishop Cranmer appears at one time to have been disposed to follow Luther's course, and to present to the people, in an English dress, some at least of the hymns of the ancient church.

The example thus set produced in England the translation commonly known as the "Old Version" of the Psalms. It was begun by Thomas Sternhold, whose position in the household of Henry VIII., and afterward of Edward VI., was similar to that of Marot with Francis I., and whose services to the former of those kings were rewarded by a substantial legacy under his will. Sternhold published versions of thirty-seven Psalms in 1549, with a dedication to King Edward, and died soon afterward. A second edition appeared in 1551, with seven more Psalms added, by John Hopkins, a Suffolk clergyman. The work was continued during Queen Mary's reign by British refugees at Geneva, the chief of whom were William Whittingham (afterward dean of Durham), who succeeded John Knox as minister of the English congregation there, and William Kethe (or Keith), said by Strype to have been a Scotchman. They published at Geneva in 1556 a service-book, containing fifty-one English metrical Psalms, which number was increased, in later editions, to eighty-seven. On the accession of Queen Elizabeth, this Genevan Psalmody was at once brought into use in England—first (according to a letter of Bishop Jewell to Peter Martyr, dated March 5, 1560) in one London church, from which it quickly spread to others both in London and in other cities. Jewell describes the effect produced by large congregations, of as many as 6,000 persons, young and old, women and children, singing it after the sermons at St. Paul's Cross. The first edition of the completed "Old Version" (containing forty Psalms by Sternhold, sixty-seven by Hopkins, fifteen by Whittingham, six by Kethe, and the rest by Thomas Norton, a barrister, Robert Wisdom, John Mardley, and Thomas Churchyard) appeared in 1562.

In this book, as published in 1562, and for many years afterward, there were (besides the versified Psalms) eleven metrical versions of the "Te Deum," canticles, Lord's Prayer, etc., etc. (the best of which is that of the "Benedicite"); and also "Da pacem, Domine," a hymn suitable to the times, rendered into English from Luther; two original hymns of praise, to be sung before Morning and Evening Prayer; two penitential hymns (one of them the "Humble Lamentation of a Sinner"); and a hymn of faith, beginning, "Lord in Thee is all my trust." In these respects, and also in the tunes which accompanied the words, there was a departure from the Genevan platform.

Two changes bearing on church hymnody were made upon the revision of the Prayer-book after the Restoration, in 1661-62. One was the addition, in the offices for consecrating bishops and ordaining priests, of the shorter version of "Veni Creator" ("Come, Holy Ghost, our souls inspire"), as an alternative form. The other, and more important, was the insertion of the rubric after the third Collect, at Morning and Evening Prayer: "In quires and places where they sing, here followeth the Anthem."

The "New Version" of the Psalms, by Dr. Nicholas Brady and the poet-laureate Nahum Tate (both Irishmen), appeared in 1696, under the sanction of an order in council of William III., "allowing and permitting" its use "in all such churches, chapels, and congregations as should think fit to receive it." No hymns were then appended to it; but the authors added a "Supplement" in 1703, which received an exactly similar sanction from an order in council of Queen Anne. In that Supplement there were several new versions of the canticles, etc., and of the "Veni Creator;" a variation of the old "Humble Lamentation of a Sinner;" six hymns for Christmas, Easter, and Holy Communion (all versions or paraphrases of Scripture), which are still usually printed at the end of the Prayer-books containing the new version; and a hymn "On the Divine use of Music"—all accompanied by tunes. The authors also reprinted, with very good taste, the excellent version of the "Benedicite" which appeared in the book of 1562. Of the hymns in this "Supplement," one ("While shepherds watched their flocks by night") greatly exceeded the rest in merit. It has been ascribed to Tate, but it has a character of simplicity unlike the rest of his works.

Conspicuous among the sacred poets of the first two Stuart reigns in England is the name of George Wither, an accomplished layman, of strong church principles, whose fate it was to be opposed and slighted while he was a stanch churchman and Royalist, and afterward to be driven into the parliamentary and Puritan ranks; for which cause, probably, recognition was denied to his genius as a poet by Dryden, Swift, and Pope. He had almost fallen into oblivion, when attention was recalled to his merits by the more discerning criticisms of Charles Lamb and Southey; and, when his *Hallelujah* was republished in 1857 by Mr. Farr, only two copies of it were known to exist, one in the British Museum, and another which had been in Mr. Heber's library.

Wither wrote, generally, in a pure nervous English idiom, and preferred the reputation of "rusticity" (an epithet applied to him even by Baxter) to the tricks and artifices of poetical style which were then in favor. It may be partly on that account that he has been better appreciated by posterity than by his contemporaries.

The hymns of Milton (on the Nativity, Passion, Circumcision, and "at a Solemn Music"), written about 1629, in his early manhood, were probably not intended for singing; but they are odes full of characteristic beauty and power.

During the Commonwealth, in 1654, Jeremy Taylor published, at the end of his *Golden Grove*, twenty-one hymns, described by himself as "celebrating the mysteries and chief festivals of the year, according to the manner of the ancient church, fitted to the fancy and devotion of the younger and pious persons, apt for memory, and to be joined to their other prayers."

Three other eminent names of the seventeenth century remain to be mentioned, John Dryden, Bishop Ken, and Bishop Simon Patrick; with which may be associated that of Addison, though he wrote in the eighteenth century.

The English Independents, as represented by Doctor Watts, have a just claim to be considered the real founders of modern English hymnody. Watts was the first to understand the nature of the want, and, by the publication of his *Hymns* in 1707-1709, and *Psalms* (not translations, but hymns founded on psalms) in 1719, he led the way in providing for it. His immediate followers were Simon Browne and Doddridge. Later in the eighteenth century, Hart, Gibbons, Grigg, and Mrs. Barbauld (the first two Independents, the last two Presbyterians), and Miss Steele, Medley, Samuel Stennett, Ryland, Beddome, and Swaine (all Baptists), succeeded to them.

Attention must be directed to the hymns produced by the "Methodist" movement, which began about 1738, and which afterward became divided, between those esteemed Arminian, under John Wesley, those who adhered to the Moravians, when the original alliance between that body and the founders of Methodism was dissolved, and the Calvinists, of whom Whitfield (himself no poet) was the leader, and Selina, countess of Huntingdon, the patroness. Each of these sections had its own hymn-writers, some of whom did, and others did not, secede from the Church of England. The Wesleyans had Charles Wesley, Seagrave, Olivers and Bakewell; the Moravians, Cennick and Hammond (with whom, perhaps, may be classed John Byrom, who imbibed the mystical ideas of some of the German schools); the Calvinists, Toplady, Berridge, William Williams, Madan, Batty, Haweis, Rowland Hill, John Newton, and Cowper.

Among all these writers, the palm undoubtedly belongs to Charles Wesley. In the first volume of hymns published by the two brothers are several good translations from the German, believed to be by John Wesley, who, although he translated and adapted, is not supposed to have written any original hymns; and the influence of German hymnody, particularly of the works of Paul Gerhardt, Scheffler, Tersteegen, and Zinzendorf, may be traced in a large proportion of Charles Wesley's works. Of his spirited style there are few better examples than "O for a thousand tongues to sing," "Blow ye the trumpet, blow," "Rejoice, the Lord is King," and "Come, let us join our friends above;" of his more tender vein, "Happy soul, thy days are ended;" and of his fervid, contemplative style (without going beyond hymns fit for general use), "O Thou who camest from above," "Forth in thy name, O Lord, I go," and "Eternal Beam of Light Divine." With those whose taste is for hymns in which warm religious feelings are warmly and demonstratively expressed, "Jesus, lover of my soul," is as popular as any of these.

The Moravian Methodists produced few hymns now available for general use. The contributions of the Calvinistic Methodists to English hymnody are of greater extent and value. Few writers of hymns had higher gifts than Augustus Montague Toplady, author of "Rock of Ages," by some esteemed the finest in the English language.

If the number as well as the quality of good hymns

available for general use is to be regarded, the authors of the "Olney Hymns" are entitled to be placed at the head of all the writers of this Calvinistic school. The greater number of the Olney Hymns are, no doubt, homely and didactic; but to the best of them (and they are no inconsiderable proportion) the tenderness of Cowper and the manliness of Newton give the interest of contrast, as well as that of sustained reality. Cowper's hymns in this book are, almost without exception, worthy of his name. Among them are "Hark, my soul, it is the Lord," "There is a fountain filled with blood," "Far from the world, O Lord, I flee," "God moves in a mysterious way," and "Sometimes a light surprises." Some, perhaps, even of these, and others of equal excellence (such as "O for a closer walk with God"), speak the language of a special experience, which, in Cowper's case, was only too real, but which could not (without a degree of unreality not desirable in exercises of public worship) be applied to themselves by all ordinary Christians.

During the first quarter of the present century there were not many indications of the tendency, which afterward became manifest, to enlarge the boundaries of British hymnody. A few, indeed, of Bishop Heber's hymns, and those of Sir Robert Grant (which, though offending rather too much against John Newton's canon, are well known and popular), appeared between 1811 and 1816, in the *Christian Observer*. In John Bowdler's *Remains*, published soon after his death in 1815, there are a few more of the same, perhaps too scholar-like, character. But the chief hymn-writers of that period were two clergymen of the Established Church—one in Ireland, Thomas Kelly, and the other in England, William Hurn—who both became Nonconformists, and the Moravian poet, James Montgomery, a native of Scotland.

During this first quarter of the present century, the collections of miscellaneous hymns for congregational use, of which the example was set by the Wesleys, Whitfield, Toplady, and Lady Huntingdon, had greatly multiplied; and with them the practice (for which, indeed, too many precedents existed in the history of Latin and German hymnody) of every collector altering the compositions of other men without scruple, to suit his own doctrine or taste: with the effect, too generally, of patching and disfiguring, spoiling and emasculating the works so altered, substituting neutral tints for natural coloring, and a dead for a living sense. In the Church of England, the use of these collections had become frequent in churches and chapels (principally in cities and towns) where the sentiments of the clergy approximated to those of the Nonconformists. In rural parishes, when the clergy were not of the "Evangelical" school, they were generally held in disfavor; for which (even if doctrinal prepossessions had not entered into the question) the great want of taste and judgment often manifested in their compilation, and perhaps also the prevailing mediocrity of the bulk of the original compositions from which most of them were derived, would be enough to account. In addition to this, the idea that no hymns ought to be used in any services of the Church of England (except prose anthems after the third collect), without express royal or ecclesiastical authority, continued down to that time largely to prevail among churchmen of the higher school.

Two publications, which appeared almost simultaneously in 1827—Bishop Heber's *Hymns*, with a few added by Dean Milman, and Keble's *Christian Year* (not a hymn-book, but one from which several admirable hymns have been taken, and the well-spring of many streams of thought and feeling by which good hymns have since been produced)—introduced a new epoch,

breaking down the barrier as to hymnody which had till then existed between the different theological schools of the Church of England. In this movement Bishop Mant was also one of the first to coöperate. It soon received a great additional impulse from the increased attention which, about the same time, began to be paid to ancient hymnody, and from the publication in 1833 of Bunsen's *Gesangbuch*. Among its earliest fruits was the *Lyra Apostolica*, containing hymns, sonnets, and other devotional poems, most of them originally contributed by some of the leading authors of the *Tracts for the Times* to the *British Magazine*; the finest of which is the pathetic "Lead, kindly Light, amid th' encircling gloom," by John Henry (now Cardinal) Newman, well known, and universally admired. From that time hymns and hymn-writers rapidly multiplied in the Church of England, and in Scotland also, and their number is still on the increase. Nearly 600 authors, whose publications were later than 1827, are enumerated in Mr. Sedgwick's catalogue of 1863, and many more have since appeared. To mention all the authors of good hymns since the commencement of this new epoch would be impossible; but probably no names could be chosen more fairly representative of its characteristic merits, and perhaps also of some of its defects, than those of Josiah Conder and James Edmeston among English Nonconformists; Henry Francis Lyte and Charlotte Elliott among evangelicals in the Church of England; John Mason Neale and Bishop Christopher Wordsworth among English churchmen of the higher school; and, in Scotland, Dr. Horatius Bonar. Criticism, in this place, of the works of these and other living or recent authors, or of those of Heber and Keble, which are on everybody's lips, and in everybody's hands, would be at once premature and superfluous.

What has been said of British hymnody during the last fifty years is equally true of American. The American hymn-writers belong to the same schools, and have been affected by the same influences. Some of them enjoy a just reputation on both sides of the Atlantic. Among those best known are Bishop Doane, Doctor Muhlenberg, and Mr. Thomas Hastings; and it is difficult to praise too highly such works as the Christmas hymn, "It came upon the midnight clear," by Mr. Edmund H. Sears; the Ascension hymn, "Thou, who didst stoop below," by Mrs. S. E. Miles; and two by Dr. Ray Palmer, "My faith looks up to Thee, Thou Lamb of Calvary," and "Jesus, Thou joy of loving hearts," the latter of which is the best among several good English versions of "Jesu, dulcedo cordium."

HYPATIA, mathematician, philosopher, and finally one of the martyrs of paganism, was the daughter and disciple of the mathematician and philosopher Theon, and was born in Alexandria not earlier than 350 A.D. After a long period of study (partly, perhaps, in Athens) she became a distinguished lecturer on philosophy in her native town, and ultimately became the recognized head of the Neo-Platonic school there (c. 400). The fascination of her great eloquence (she is said on more than one occasion to have proved an effective advocate in the courts of law), and the charm of a rare modesty and beauty, combined with her remarkable intellectual gifts to attract to her class-room a large number of disciples, over some of whom her influence was very great. Among these was Synesius, who afterward (c. 410) became bishop of Ptolemais, several of whose letters addressed to her, full of chivalrous admiration and reverence, are still extant. In the conflicts between the various elements of Alexandrian society which took place shortly after the accession of Cyril to the patriarchate in 412, she became closely identified as counselor and friend with the prefect

Orestes, and in the same degree made herself an object of fear and hatred to the Nitrian monks and the fanatical Christian mob, by whom she was ultimately murdered under circumstances of revolting barbarity. Socrates has related how she was torn from her chariot, dragged to the Cæsareum (then a Christian church), stripped naked, cut to pieces with oyster shells, and finally burnt piecemeal. Most prominent among the actual perpetrators of the crime was one Peter, a reader; but there seems little reason to doubt Theodoret's assertion of Cyril's real complicity.

HYPERIDES, one of the ten Attic orators, was son of Glaucippus, of a noble family of the tribe Ægeis and the deme Collytus. He was probably younger than Lycurgus (born about 396 B.C.) and older than Demosthenes, (born about 385 B.C.) Having studied under Isocrates, he began life as a writer of speeches for the courts, and in 360 B.C. he prosecuted Autocles, a general charged with treason in Thrace. From the end of the Sacred War, 346-324 B.C., Hyperides supported Demosthenes in the struggle against Macedon; but in the affair of Harpalus he was one of the ten public prosecutors of Demosthenes, and on the exile of his former leader he became the head of the patriotic party (see DEMOSTHENES). He was the chief promoter of the Lamiian War against Antipater and Craterus. After the decisive defeat of Crannon, 322 B.C., Hyperides with the other orators demanded by Antipater was condemned to death by the subdued Athenians, but fled to Ægina and thence into sanctuary in the temple of Demeter at Hermione. Antipater's emissaries dragged him forth to be put to death at Athens.

HYPERTROPHY (*ὑπέρ* over, *τροφή* nourishment) a term in medicine employed to designate an abnormal increase in bulk of one or more of the organs or component tissues of the body. In its strict sense this term can only be applied where the increase affects the natural textures of a part, and is not applicable where the enlargement is due to the presence of some extraneous morbid formation. Hypertrophy of a part may manifest itself either by simply an increase in the size of its constituents, or by this combined with an increase in their number (hyperplasia). In many instances both are associated.

HYPNOTISM is now extensively used on the continent of Europe in treating disease, and is slowly finding its way into practice in the United States. It is impossible to suppose that hypnotism will ever fulfill the sanguine expectations of many of its exponents, though it seems possible that it may render aid as a therapeutic agent in treating some kinds of diseases. It is still necessary to write very guardedly upon the subject, as its action when used for the cure of disease is imperfectly understood. Hypnotism is not any longer to be regarded as a mystery or as a superhuman gift, for its action can for the most part be explained by our present knowledge of physiology and psychology. The chief reason why hypnotism cannot be universally employed as a therapeutic agent is the fact that only a certain proportion of persons can be hypnotized. The proportion, however, of persons insusceptible to its power is much less than was at one time thought; and, when used therapeutically, somnambulism, the deepest stage of hynotism, is not necessary. On the Continent it is found that about 80 per cent. of the inhabitants can be hypnotized.

Hypnosis may be used in two ways in relation to disease. In the first place, simple sleep is induced, and sleep when produced without the action of drugs is often of great importance, and of itself aids in treatment. Again, in many cases when the person is asleep, suggestions may be made to him which will abolish

pain, and which in some diseases will bring about either the relief of symptoms or the cure of the disease. Every one knows that the mind influences the body, and that concentrated thought can bring about sensations in various localities. It is upon this knowledge that the hypnotist bases his practice. The patient being placed in a hypnotic sleep, his attention is directed to various parts of the body, and very often the effect is increased through local stimulation by means of passes or rubbing. During the hypnotic sleep the patient is uninfluenced by his surroundings, and therefore he is all the more open to suggestions, and no disturbing influences diminish his powers of concentration. By means such as these neuralgic or rheumatic pains may frequently be removed; headaches may often be cured, and so may some forms of dyspepsia, as well as the various manifestations of hysteria and hypochondriasis, and even functional paralysis. It is found, too, that hypnotism is useful in dipsomania and in treating persons addicted to opium-eating and other depraved tastes. At present it cannot be said that hypnotism is of use in any disease having an organic origin, although in such diseases various symptoms, especially those of pain, may be removed successfully. It is quite possible for operations to be performed upon persons under the hypnotic influence without the slightest pain being felt by the patient; but as various other anæsthetics are more easily employed, it is only in a few cases where these are contra-indicated that hypnotism will be used in this connection.

For educational purposes it is held possible to impress a person in the hypnotic sleep with ideas which will modify his usual character. For instance, it seems possible in many cases to cure persons of bad habits, such as stealing, lying, or the excessive use of alcohol; and attempts are being made to influence habitual criminals for good by hypnosis. Young children, defective in brain power or constitutionally vicious, may be improved by careful hypnotic treatment. It is a mistake to suppose that hypnotism can only be used successfully in treating nervous or hysterical persons. Such persons are often difficult to hypnotize, and there is always a danger of either increasing their troubles or in some cases of inducing insanity. Ordinary individuals, especially those who have learned to obey, are the subjects whom a hypnotist would prefer to treat. In many cases of insanity hypnotism may be used with advantage as a therapeutic agent, although its employment in these cases is not by any means easy. Persons suffering from hallucinations, it is said, have been cured, and those who suffer from the painful result of some grievous trouble have been restored by having the incident blotted out from their memory.

Although hypnotism has power for good when properly used by medical men, it is an exceedingly dangerous weapon in the hands of the unskillful and unscrupulous. All public exhibitions of hypnotism should be prohibited by law, as persons experimented upon have been rendered lunatics, or had their nervous systems severely damaged.

HYPOCHONDRIASIS (synonyms, the spleen, the vapors). As the name implies, hypochondriasis and its symptoms were referred by the ancients, and indeed by physicians down to the time of Cullen, to diseases or derangements of one or more of the abdominal viscera. Cullen classified it among nervous diseases, and Falret more fully described it as a morbid condition of the nervous system characterized by depression of feeling and false beliefs as to an impaired state of the health.

HYPODERMIC INJECTION. This method, first introduced by the late Dr. Alexander Wood of Edinburgh, is an extremely valuable one in certain cases,

though its applicability is limited. It consists in the injection of a solution of the substance to be given beneath the skin, by means of a fine hollow needle to which a small syringe is attached. The prick given by the needle is much less acutely felt by the patient if the needle be lubricated with carbolic oil or the like. Absorption from the subcutaneous tissue takes place speedily, and is not interfered with by vomiting, or other conditions of the stomach which may delay or prevent the entrance of the remedy into the system by that channel. The action of the drug is thus at once more rapid and more certain than when administered by the mouth; and a smaller dose is required. Only such substances as can be given in small bulk and in an unirritating condition are available. It is thus chiefly of use for the vegetable alkaloids, of which morphia is far the most often employed. It need hardly be said that it is to be used only by skilled hands. The same method is largely employed in experiments on the action of disease, poisons in animals, and in Pasteur's treatment of hydrophobia.

HYPOTHEC (*Hypotheca*), in Roman law is the most advanced form of the contract of pledge. A specific thing may be given absolutely to a creditor on the understanding that it is to be given back when the creditor's debt is paid; or the property in the thing may be assigned to the creditor while the debtor is allowed to remain in possession, the creditor as owner being able to take possession if his debt is not discharged. Here we have the kind of security known as pledge and mortgage respectively.

HYRAX, a genus of diminutive plantigrade mammals, the position of which in the mammalian series has, owing to their apparent affinity with several widely different groups, given rise to considerable controversy. Professor Huxley established the order *Hyracoidea* for their reception. They are small, rabbit-like creatures, the largest not exceeding eighteen inches in length, covered with a thick, soft fur with numerous bristles interspersed. Their ears and legs are short; the tail is represented only by a small tubercle; and their toes, of which they have four on each foot in front and three behind, are, with the exception of the inner one on each hind foot, provided with flat, hoof-like nails. They have twenty-one pairs of ribs—a larger number than is possessed by any other mammal except the sloths, which have twenty-three pairs. They are gregarious animals, dwelling in colonies in the crevices of rocks and in the caverns which abound in the hilly regions they frequent, and feeding on grass and other herbage, on roots, fruits, and the tender shoots of plants.

HYRCANIA, a province of Asia, south of the Caspian Sea, and bounded on the east by the river Oxus. It was, however, a wide and indefinite tract, the extent of which is variously conceived. Its chief city is called Tape by Strabo, Zadracarta by Arrian. The latter is evidently the same as Carta, mentioned by Strabo as an important city.

HYRCANUS (Ἰρκανός), a Greek surname, of unknown origin, borne by several Jews of the Macbean period.

JOHN HYRCANUS I., high priest of the Jews from 135 to 105 B.C., was the youngest son of Simon Maccabeus. He died in 105, and was succeeded by Aristobulus, the eldest of his five sons.

JOHN HYRCANUS II., high priest from 78 to 40 B.C., was the eldest son of Alexander Jannæus by his wife Alexandra, and was thus a grandson of the preceding. When his father died in 78, he was by his mother forthwith appointed high priest, and on her death in 69 he claimed the succession to the supreme civil authority also. In 41 B.C. he was practically superseded by

Antony's appointment of Herod and Phasael to be tetrarch of Judæa; and in the following year he was taken prisoner by the Parthians, deprived of his ears that he might be permanently disqualified for priestly office, and carried to Babylon. He was permitted in 33 B.C. to return to Jerusalem, where, on a charge of treasonable correspondence with Malchus, king of Arabia, he was put to death in 30 B.C.

HYSSOP (*Hyssopus officinalis*), a garden herb belonging to the natural order *Labiata*, cultivated for use in domestic medicine. It is a small perennial plant about two feet high, with slender, quadrangular, woody stems; narrowly elliptical, pointed, entire, dotted leaves, about one inch long and one-third inch wide, growing in pairs on the stem; and long, terminal, erect, half-verticillate, leafy spikes of small, violet-blue flowers, which are in blossom from June to September. Two varieties of the plant occur in gardens, one having variegated leaves and the other reddish flowers. The leaves have a warm, aromatic, bitter taste, and are believed to owe their properties to a volatile oil which is present in the proportion of $\frac{1}{4}$ to $\frac{1}{2}$ per cent. Hyssop is a native of the south of Europe, its range extending eastward to Siberia; it was introduced into England by Gerard in the year 1596. A strong tea made of the leaves, and sweetened with honey, was formerly used in pulmonary and catarrhal affections, and externally as an application to bruises and indolent swellings.

The Hedge Hyssop (*Gratiola officinalis*) belongs to the natural order *Scrophulariaceæ*, and is a native of marshy lands in the south of Europe, whence it was introduced into Britain nearly 300 years ago.

HYSTERIA, a term applied to a disordered condition of the nervous system, the anatomical seat and nature of which are unknown to medical science, but of which the symptoms consist in well-marked and very varied disturbances of nerve function. By the ancients and by modern physicians down to the time of Sydenham its symptoms were supposed to be due to disturbances of the uterus (*ὕστέρια*, whence the name), but it is now universally recognized that they are dependent on a variety of causes with which that organ has no necessary connection. The causes of hysteria may be divided into the predisposing, such as hereditary predisposition to nervous degeneration, sex, age, occupation, and national idiosyncrasy; and the immediate, such as mental and physical exhaustion, fright, and other emotional influences, pregnancy, the puerperal condition, diseases of the uterus and its appendages, and the depressing influence of injury or general disease. Each and all of these causes may act and react in any given case; in fact, it is nearly always impossible to assign a particular cause in a particular instance. Perhaps, taken over all, hereditary predisposition to nerve-instability may be asserted as the most prolific cause. It is often noticed in families in which this instability exists that hysteria presents itself to a greater or less extent in a considerable number of its members as the sole indication of the diathesis. As regards age the condition is apt to appear at the evolutionary periods of life—puberty, pregnancy, and the climacteric—without any further assignable cause except that first spoken of. It is very frequent in girls between the ages of twelve and fifteen, and in women on the cessation of the menstrual flow. It is much more common in the female than the male—in the proportion of twenty to one—which circumstance, points to the important influence of the uterus in causation, but definitely places hysteria in the category of nervous diseases. It has been asserted that certain races are more liable to the disease than others—that for instance, the Latins and the Slavs are more prone to it than other inhabitants of Europe. This, however, is

doubtful; in the more excitable races we find on the whole a greater tendency to hysterical excitement, in those whose national characteristic is calm and impassionateness a tendency to hysterical depression; and it is probable that the greater prominence of the symptoms in the former may have masked the more subtle yet not less important manifestations of the disease presented in the latter. Occupation, or be it rather said want of occupation, is a prolific cause. This is noticeable in all classes of society; in the higher the idle, luxurious woman concentrates herself upon herself, and the frivolity of her existence helps to aggravate the evil which may be innate in her constitution; in the lower classes the disease is not so prevalent except among women who live a vicious and excited life. The experience of prison authorities shows not only that women of the criminal classes are individually liable to the hysterical paroxysm, but that it is very apt to assume an epidemic form among them. There is no proof that any particular legitimate occupation tends to its development. The depressing effects of almost any disease may be directly productive of hysteria, more especially those accompanied by pain and loss of sleep. There can be little doubt, however, that disease of the uterus and its appendages has a greater tendency toward its production than disease of any other system. At the same time, hysteria seems to follow more frequently on the less severe than on the graver forms of uterine complaints.

In point of duration hysteria may be transient or chronic. In the first phase it consists of an explosion of emotionalism, generally the result of mental excitement, to which the popular term "hysterics" is applied. Such attacks are generally preceded and accompanied by a sensation of a lump in the throat (the "globus hystericus"), a flow of limpid urine, violent outbursts of alternate laughter and weeping, and sometimes even convulsion. In the chronic condition we find an extraordinary complexity of symptoms, both physical and mental. These are continuous, constituting the "status hystericus," and paroxysmal. The physical symptoms are extremely diverse; there may be a pseudo-paralysis, the patient lying palsied wholly or partially, or there may be rigidity of one or more limbs, in either case the system persisting for weeks or months or even years; there may be flushing or pallor of the face, an increase or decrease of temperature. Perversions of sensation are frequent symptoms; these consist in complaint of pain, generally of a local character; a common instance is the sensation of a nail being driven through the vertex of the head ("clavus hystericus"), or of increased sensibility of particular parts. On the other hand loss of sensation may be complained of, or, as occasionally happens, hyperæsthesia and anæsthesia may be stated by an individual to exist in different parts of the body. The region of the spine is a very frequent seat of hysterical pain. Pain, more especially when referred to a joint, is apt to be accompanied by swelling. Both the motor and the sensory symptoms are in every instance out of all proportion to any assignable cause, and for the most part disappear suddenly, leaving the patient in perfect health. It is to such cases that the wonderful cures effected by quacks and charlatans may be referred. The mental symptoms have not the same tendency to pass away suddenly. They may be spoken of as inter-paroxysmal and paroxysmal. The chief characteristics of the former are extreme emotionalism combined with a curious obstructiveness, a desire to be an object of importance, and a constant craving for sympathy. This is sought to be procured at an immense sacrifice of personal comfort, and to this may be referred a very large proportion of the motor and sensory symptoms above spoken of. The paroxysmal condition does not materially differ from the transient

hysterical attack, except that convulsion is more common and more violent. The special senses of taste, sight and hearing may be affected, sometimes temporarily obliterated. Hysteria may pass into absolute insanity.

Treatment consists in attention to the general health, and to such special symptoms as may arise, notably those connected with the function of menstruation. The submission of the patient to the best moral influences is of no mean importance. But it may be admitted that the results are generally unsatisfactory so far as medication is concerned, as the cure is usually spontaneous or dependent on some sudden mental influence.

HYSTERO-EPILEPSY, a nervous disease of women, occurring during the fertile period of life, first observed and described by Professor Charcot of Paris. Its phenomena are very extraordinary, and serious doubts have been entertained by eminent authorities as to their substantiality, it being asserted that they are merely manifestations of ordinary hysteria, intensified by a process of education. But these doubts are being rapidly dissipated by the observations of competent observers. The disease is of a paroxysmal nature, and its symptoms may be divided into inter-paroxysmal and paroxysmal. The former consist of extreme sensitiveness over the region of one or (less frequently) both

ovaries, and loss of tactile sensibility and complete insensibility to pain in one lateral half of the body, the side on which ovarian tenderness exists. Sight is sometimes implicated, manifested by a peculiar form of color-blindness. Perhaps the most remarkable phenomenon presented in this disease is that all these impairments of sensation may be shifted to the other side of the body on the application of magnets and plates of metals, the originally affected side regaining sensibility so long as the opposite one is insensible. In some cases the symptoms are permanently bilateral. The paroxysm consists in violent general convulsion, epileptiform in character, which is at once checked by pressure over the tender ovary. The mental faculties are generally weakened, and the disease is for the most part incurable.

HYTHE, a municipal and parliamentary borough of Kent, England, and one of the original Cinque Ports, is beautifully situated at the foot of a steep cliff near the eastern extremity of Romney Marsh, about half a mile from the sea, on a branch line of the South-Eastern Railway, sixty-six miles east-southeast of London, sixteen southwest of Dover, and five west of Folkestone. Population (1890), 4,173.

I.

I is one of those symbols which the Greeks employed differently from the Phœnicians. In Phœnician it denoted the palatal semi-vowel *y* called in Hebrew *yodh*. The Greeks disliked this sound, and it vanished at an early time out of their language. Consequently they needed no symbol to represent it, and could use the Phœnician symbol to denote that for which the Phœnician alphabet gave them no help, namely, the vowel *i*. Generally we find it in Greek in the single straight line with which we are familiar. It has no other form in the Latin alphabet. In the last century before Christ, the Romans sometimes lengthened the symbol to denote the long vowel, so that it reached above the top of the line, while the short vowel was expressed by a line of the usual length.

The value of the symbol is generally constant in all European languages, ancient or modern, with the exception of English. It is the vowel sound produced by raising the front of the tongue toward the palate, as high as it can be raised without touching. The lips are not rounded; by rounding them, when the tongue is in this position, we should produce the sound of the French *u* or the German *ü*. The vowel may, however, be either open or close, and in either of these cases it may be short or long. Therefore we have four variations, of which, however, probably not more than two are found in any spoken language:—(1) the short open *i*, heard in English “sin;” (2) the long open *i*, which is not one of our spoken sounds, but can be produced in singing; (3) the short, close *i*, which again is not English, but is the Italian short *i*; (4) the long, close *i*, which is the Italian long *i*, and is also common in English; but we denote the sound, not by *i*, but by *ee*, as in “seen.” It is generally supposed that the sound of *ee* stands to that of *i* in English as a long vowel to the corresponding short; but this is not so; there is a difference in quality as well; *ee* denotes (as has just been explained) a close vowel, whereas *i* is open. It is true that in ordinary English the open vowel *i* only occurs short, and the close vowel long, therefore the confusion is natural. A Scotchman, however, finds no difficulty in pronouncing “seen” short.

IAMBLICHUS, the chief representative of Syrian Neo-Platonism, is only imperfectly known to us in the events of his life and the details of his creed. We learn, however, from Suidas, and from his biographer Eunapius, that he was born at Chalcis in Cœle-Syria, the scion of a rich and illustrious family; that he studied under Anatolius, and afterward under Porphyry, the pupil of Plotinus; that he himself gathered together a large number of disciples of different nations, with whom he lived on terms of genial friendship; that he wrote “various philosophical books,” and that he died during

the reign of Constantine—according to Fabricius, before 333 A.D. His residence (probably) at his native town of Chalcis was varied by a yearly visit with his pupils to the baths of Gadara. Of the books referred to by Suidas only a fraction has been preserved.

IBADAN, a large and flourishing town of West Africa, in the Yoruba country, about eighty miles inland from Lagos, and about fifty miles to the northeast of Abeokuta. The population of Ibadan is not less than 100,000. The great bulk of the population consists of slaves. There are twenty-four mosques and several Mahometan schools in the town.

IBARRA, a city of Ecuador in South America, the capital of the province of Imbabura, is situated on a plain about 2,000 feet lower than Quito, from which it is thirty miles distant. Before the earthquake of 1868 it was a place of considerable prosperity, with regular streets and well-built houses, and about 13,000 of a population, but in that terrible disaster it is estimated that no fewer than 10,000 of its inhabitants perished.

IBERIANS. To the question, Who are the Iberians? it is impossible to give a satisfactory answer in the form of a concise definition. While our knowledge of their actual history is comparatively slight, the position which they have acquired in modern ethnographical theory is at once a prominent and a perplexing one. It is almost impossible to hazard any statement in regard to them which will not find an impugning voice from one quarter or other. Historical, numismatical, linguistic, and anthropological evidences have been brought to bear on the problem of their affinity, and the result is on the whole not so much light as darkness visible.

The name Iberians seems to have been applied by the earlier Greek navigators to the peoples who inhabited the eastern coast of Spain; and there is considerable probability in the suggestion that it originally meant the riparians of the Iberus or Ebro. On the other hand, the term Iberia is said to have embraced in older Greek usage the country as far east as the Rhone, and by the time of Strabo it was the common Greek name for the Spanish peninsula—Iberians meaning sometimes the inhabitants of the peninsula in general, and sometimes, it would appear, the peoples of a definite race. Of the tribal distribution of this race, of its linguistic, social, and political characteristics, and of the history of its relation to the other peoples of Spain, we have only the most general, fragmentary, and in part self-contradictory accounts. On the whole our historical evidence authorizes the assertion that in Spain, when it first became known to the Romans and Greeks, there existed a large number of separate and variously civilized tribes connected with each other by at least apparent identity of race, and by similarity (but not

identity) of language, their general characteristics sufficiently differencing them from Phœnicians, Romans and Celts. The statement that the mingling of these Iberians with the immigrant Celts gave rise to the Celtiberians (Keltiberians) is in itself sufficiently probable, and has been impugned by nothing more precise than the general untrustworthiness of the author by whom it is made (Diodorus Siculus). Varro and Dionysius Afer went so far as to identify the Iberians of Spain with the Iberians of the Caucasus, the one regarding the eastern and the other the western settlements as of earlier date.

IBEX, the common name of several closely allied species of ruminant mammals, belonging to the genus *Capra* or goats, inhabiting the loftiest regions of Europe, Asia, and Africa. The European ibex or steinboc (*Capra ibex*) abounded during the Middle Ages among the higher mountain ranges of Germany, Switzerland, and the Ural, but has since disappeared from the greater part of this area, being now almost wholly confined to the Alps which separate Valais from Piedmont, and to the lofty peaks of Savoy, where its continued existence is mainly due to the action of protective game laws. The ibex is a handsome animal, measuring about four and one-half feet in length and two and one-half feet high; its skin is covered in summer with a short fur of an ashy gray color, and in winter with much longer yellowish-brown hair concealing a dense fur beneath. A short beard is present in the male in winter, but, as it disappears altogether in spring, Darwin regards this appendage as rudimentary. The horns, especially in the male, form a striking feature: rising from the crest of the skull, they bend gradually backward, attaining a length in old specimens of about two feet; they are thick and flat, and have the anterior face ridged with knotty transverse bands. In the female the horns never exceed half a foot in length, and are much less rugose than in the male. The front legs are somewhat shorter than those behind, which enables the ibex to ascend the mountain slopes with more facility than it can descend, while its hoofs are as hard as steel, rough underneath, and when walking over a flat surface capable of being spread out. These, together with its powerful sinews, enable it to take prodigious leaps, to balance itself on the smallest foothold, and to scale almost perpendicular rocks. The ibex lives habitually at a greater height than the chamois or any other of the Alpine mammals, its vertical limit being the line of perpetual snow. There it rests in sunny nooks during the day, descending at night to the highest woods to graze, and retiring at sunrise to its snowy fastnesses. This return journey forms the ibex hunter's opportunity. To get within gunshot the huntsman has usually to approach from above; accordingly he ascends to the limit of perpetual snow, and there passes the night among the daily haunts of the ibex, lying in wait from early dawn for its return. The ibexes are gregarious, feeding in herds of ten to fifteen individuals; the old males, however, generally live apart from, and usually at greater elevations than, the females and young. They are said to give out a sharp whistling sound not unlike that of the chamois, but when greatly irritated or frightened they make a peculiar snorting noise. The period of gestation in the female is ninety days, after which she produces—usually at the end of June—a single young one, which is able at once to follow its mother. These when caught young and fed on goat's milk can, it is said, be readily tamed; and in the sixteenth century young tamed ibexes were frequently driven to the mountains along with the goats, in whose company they would afterward voluntarily return. Even wild specimens have thus been known to stray

among the herds of goats, although, strange to say, they at all times shun the society of the chamois. The ibex was formerly hunted largely for its flesh and skin; but, although the latter, owing to its scarcity, now commands a high price, the difficulty arising from the operation of the game laws, and above all the difficulty and danger inseparable from the sport, have reduced the number of hunters to a few hardy mountaineers, who find in the pursuit of the ibex the keenest enjoyment of life. For weeks the sportsman will follow a track across fields of ice, along narrow ledges, over precipices, and across chasms, nearly frozen to death at night, and often with little more than a crust of bread for sustenance, yet considering himself more than repaid by the sight at last of his prey grazing within range of his rifle. Its flesh is said to resemble mutton, but has the flavor of game.

IBIS, one of the most sacred birds of the ancient Egyptians, which in modern times was identified by Bruce with the *Abou-Hannes* or "Father John" of the Abyssinians, and in 1790 received from Latham the name of *Tantalus aethiopicus*.

The Ibis is chiefly an inhabitant of the Nile basin in Nubia, from Dongolia southward, as well as of Kordofan and Sennaar; whence about midsummer, as the river rises, it moves northward to Egypt, and reaches the delta, passing over the intermediate districts, in a way not unknown elsewhere among migratory birds. In Lower Egypt it bears the name of *Abou-mengel*, or "Father of the Sickle," from the form of its bill, but it does not stay long in that country, disappearing, by all accounts, when the inundation has subsided. The old story told to Herodotus of its destroying snakes is, according to Savigny, devoid of truth, and that naturalist found, from dissection of the examples he obtained, that its usual food was fresh-water univalve mollusks; but Cuvier asserts that he discovered partly digested remains of a snake in the stomach of a mummied Ibis which he examined, and there can be little doubt that insects and crustaceans, to say nothing of other living creatures, enter on occasion into the bird's diet.

The Ibis is somewhat larger than a curlew, which bird it in appearance calls to mind, with a much stouter bill and stouter legs. The head and greater part of the neck are bare and black. The plumage is white, except the primaries, which are black, and a black plume, formed by the secondaries, tertials, and lower scapulars, and richly glossed with bronze, blue and green, which curves gracefully over the hind-quarters. The bill and feet are also black. The young lack the ornamental plume, and in them the head and neck are clothed with short, black feathers, while the bill is yellow. The nest is placed in bushes or high trees, the bird generally building in companies, and in the middle of August Von Heuglin found that it had from two to four young or much incubated eggs. These are of a dingy white, splashed, spotted and speckled with reddish brown.

IBN BATUTA, whose proper name was Abu-Abdullah Mahommed, one of the most remarkable of travelers and autobiographers, was born at Tangiers in 1304. He entered on his travels at the age of twenty-one (1325), and closed them in 1355. He died in 1378.

IBN EZRA. See ABENEZRA.

IBN KHALDOUN, a celebrated Arabic historian, poet, and philosopher, was born at Tunis on the 1st Ramadhan 732 A.H. (February 8, 1332). He died on the 25th Ramadhan 808 A.H. (March 16, 1406), at the age of sixty-four.

IBN KHALLIKAN, Abu'l Abbās Ahmed, better known as Ibn Khallikan, author of the celebrated Arabic biographical dictionary, was born at Arbela on September 22, 1211. He died in 1282.

IBN SINA. See AVICENNA.

IBO, IBU, IGBO, or EBOE, a district of West Africa, situated in the delta of the Niger, and mainly on the left or eastern bank of the river. The chief town, which is frequently called by the same name, but is more correctly designated Abo or Áboh, lies on a creek which falls into the main stream about 150 miles from its mouth, and contains from 6,000 to 8,000 inhabitants. The Ibo are a strong, well-built Negro race. Their women are distinguished by their embonpoint, which is considered by the people themselves as the perfection of beauty. The language of the Ibo is one of the most important in the Niger delta, and is gradually extending its area.

IBRAHIM PASHA, viceroy of Egypt, a real or adopted son of Mehemet Ali, was born at Cavalla in Roumelia in 1789. Early associated with the Egyptian army, he won a name for himself by successful operations against the rebel tribes of Upper Egypt and the fugitive Mamelukes in Nubia, before he entered his twenty-fifth year. In an expedition which he led in 1816 against the Wahhábees of Arabia, the young general was seriously hampered by the want of organized discipline among his troops, and on his triumphant return to Cairo in 1819 he eagerly availed himself of the services of some French officers in his efforts to convert the Oriental turbulence of his forces into the disciplined steadiness of the West. Ibrahim's next campaign was in Greece, whither he was ordered in August, 1824, to support the Turkish sultan's attempts to restrain the risings of Hellenic nationality. The defeat of the Turkish and Egyptian fleet at Navarino (October 20, 1827), by the united English, French and Russian squadrons was the signal for Ibrahim's recall from the Morea, which had suffered keenly at the hands of the cruel Oriental. In Egypt he at once set himself afresh to the work of reorganization in army and navy, and in 1831, when Mehemet Ali ordered an almost unprovoked invasion of Syria, Ibrahim was again at the head of the Egyptian army. Unchecked by the loss of 5,000 men from cholera before leaving Egypt, he appeared suddenly on the Syrian coast, took Gaza, Jaffa and Kaiffa by surprise, and by November 29th had invested Acre. There he met with a stubborn resistance; twice in vain he attempted to carry the seaport by storm, and in the midst of the siege he was called away, to meet an army of relief, commanded by 'Osmán Pasha, governor of Aleppo. Near Tripoli he surprised 'Osmán, who decamped without fighting, and returning hastily to Acre, he threw his whole force on the place, carrying it (May 27, 1832) with a loss of 1,400 men. Without a pause he marched on Damascus, which offered no resistance. At Hims (July 28) he encountered and defeated a Turkish army of 30,000 men, with a force of 16,000, and passing swiftly through the defiles of Beylán, overtook and completely routed the retreating enemy at Adaneh. Another victory followed at Oulou-Kislák, and then, near Konieh, Ibrahim was met by the vizier Resheed Pasha at the head of 60,000 men. Favored by a murky day—an advantage which helped to counterbalance the great disparity of his forces—he contrived to throw the Turkish army into confusion, and, by the capture of the vizier, converted an impending disaster into the most brilliant of his victories. Meantime his fleet, equally successful, had chased that of the sultan back to the Bosphorus, and the victor, without any army to oppose him, was within six marches of Constantinople. At the critical moment the order came from Mehemet Ali to await reënforcements. But before these arrived the golden opportunity was lost. The Russian army and fleet advanced to the protection of the Ottoman capital; the other Western powers combined in the effort to effect peace; and by treaty in Feb-

ruary, 1833, Syria and Adana were handed over to Mehemet on the condition of his paying tribute for them. As governor, Ibrahim reduced the new territory to order, and gave a strong impulse to industrial enterprise. But war again broke out in 1839, and at Nezeeb (June 24th) Ibrahim dealt a second deadly blow to the Turkish power. Again the commands of Mehemet forbade him to follow up his success, and the campaign, cut short by the interference of the British, ended in the restoration of Syria to the Porte in 1841. After his retreat from Damascus, achieved with martial skill, although accompanied with serious losses, Ibrahim laid down his sword. Retiring to his estates in the plain of Heliopolis, he occupied himself in establishing cotton and olive plantations, till in 1844 he was called to succeed his father as viceroy. He died at Cairo, November 9, 1848, only a few months after the formal confirmation of his rank of viceroy.

IBRAILA, BRAILA, BRAHILOW, or BRAILOW, a town formerly of Wallachia, now of Roumania, situated on the left bank of the Danube, about nine miles south of Galatz and 102 miles from the Sulina mouth of the river.

IBYCUS, a Greek lyric poet, who flourished about the sixtieth Olympiad—540 B.C.—was a native of Rhegium in Italy, but spent the greater part of his life at the court of Polycrates, tyrant of Samos. A curious story, not always accepted, is told in connection with his death. While traveling in the neighborhood of Corinth, the poet was waylaid and mortally wounded by robbers. As he lay dying on the ground, he saw a flock of cranes flying overhead, and called upon them to avenge his death. The murderers betook themselves to Corinth, and soon after, while sitting in the theater, saw the cranes hovering above. One of them, either in alarm or jest, ejaculated, "Behold the avengers of Ibycus," and thus gave the clue to the detection of the crime. The phrase, "the cranes of Ibycus," passed into a proverb among the Greeks.

ICA, YCA, or ECCA, an inland city of Peru, capital of a district in the department of Lima, situated 170 miles south-southeast of the city of Lima, and forty-eight miles south-southwest of the city of Pisco on the Pacific Ocean, with which it is connected by a railway. Between Pisco and Ica the country is a desolate and barren desert, but Ica itself lies in a fruitful valley surrounded by cornfields and vineyards. Pop., 7,000.

ICE is the solid crystalline form which water assumes when exposed to a sufficiently low temperature. It is frequently precipitated from the air as hoarfrost, snow, or hail; and in the glaciers and snows of lofty mountain systems or of regions of high latitude it exists on a gigantic scale, being especially characteristic of the seas and lands around the poles, which consequently have hitherto been practically inaccessible to man. Also in various parts of the world, especially in France and Italy, great quantities of ice form in caves, which, in virtue of their depth below the earth's surface, their height above the sea-level, or their exposure to suitable winds or to two or more of these conditions in combination, are unaffected by ordinary climatic changes, so that the mean annual temperature is sufficiently low to insure the permanency of the ice. The great ice supply for the island of Teneriffe is obtained from such a cave, which is 100 feet long, 30 feet broad, and from 10 to 15 feet high, and which is situated on a peak some 10,000 feet above the sea-level. According to the Rev. S. Browne such cave-ice is generally peculiar in its columnar appearance, and apparently less easy to melt than ordinary surface ice.

In the mutual transformations of water and ice, many remarkable physical phenomena occur. Thus, during

the process of melting a block of ice or of freezing a quantity of water, no change of temperature can take place so long as there is a thorough mixture of water and ice. Consequently, the "freezing point" or temperature at which water freezes is a temperature so readily determined that it is conveniently employed as one of the standard temperatures in the graduation of ordinary thermometer scales, such as the centigrade, the Fahrenheit, and the Réaumur. In the act of freezing, water, though its temperature remains unchanged, undergoes a remarkable expansion or increase of bulk, so that ice at 0° C. is less dense than water—a fact demonstrated at once by its power of floating. "Ground-ice" or "anchor-ice," which forms in certain circumstances at the bottom of streams, is only an apparent exception to this relation between the densities of water in its solid and liquid states, being retained there by the cohesion between it and the stones or rocks which compose the river's bed. When forcibly released from this contact with the bottom, the ice at once ascends to the surface. Ground-ice may thus be the lowest stratum of the once completely frozen mass of water, adhering to the bottom during the thawing and melting of the ice at the surface; or it may even be formed under favorable conditions below briskly flowing water, probably by the action of eddies, which draw the surface water down through the warmer but denser liquid, and thus cool the stones and rocks at the bottom. As water then expands on freezing, so conversely ice contracts on melting; and the ice-cold water thus formed continues to contract when heated until it has reached its point of maximum density. Joule, from a series of careful experiments, determined the temperature at which water attains its maximum density to be 39.1° Fahr., or very nearly 4° C. Hence water contracts as its temperature rises from 0° C. to 4° C.; but at higher temperatures it behaves like the great majority of other substances, expanding with rise of temperature. At no temperature, however, does water in the liquid state become less dense than ice.

Under the influence of heat, ice itself behaves as most solids do, contracting when cool, expanding when heated.

The growing demand for ice for domestic, medicinal, and other purposes has led, not only to the development of a regularly organized ice-trade, but also to the invention of machines for the manufacture of ice in countries which do not possess a sufficient home supply. Freezing-mixtures, such as the familiar snow and salt or the mixture of sulphate or phosphate of sodium and dilute nitric acid, may be dismissed with a word, since they are restricted in use to the production of intense cold for a brief period of time, and are incapable of economic application to the formation of large quantities of ice.

ICE MAKING AND MACHINE REFRIGERATION.

The manufacture of ice has now become a regular industry in the temperate as well as the tropical climates. The art is really old having been experimented with nearly a century ago in England and on the continent, and ice has long been made in India without other than natural means. Several mild winters in succession, as those of '89, '90, '91, probably stimulated experiment to the point of final commercial success.

The physical fact upon which the later manufactures of ice and the production of cold for storage purposes depend is that when a liquid evaporates it uses up all the heat it can get in its vicinity. The ice machine does not make any cold; it does not *produce* cold in any substance. It only extracts the heat therefrom. This cooling action can be illustrated by very simple experiments, such as the pouring of a little ether on

the land. As it evaporates there will be a decided sensation of coldness. If a bottle of water is kept wet outside with ether the water will continually grow cooler, and may eventually be frozen. If a porous earthen jar, through which the water from the interior continually oozes, be placed in the shade in warm weather, the continual evaporation from the outside surface cools perceptibly the jar and water, and this contrivance for cooling water is of very ancient date in warm countries. Before the invention of the modern ice machines, which are used in practically the same forms both for manufacturing ice and for cooling rooms for cold storage, water was frozen in bottles for daily use by setting them in trays of brine to the sides of which were attached coils or tanks for ether-vapor. The vapor cooled the brine, and the water in the bottles could be finally frozen.

But in modern machines ether is not used, being too expensive, and also inflammable. Sulphurous oxide or ammonia takes its place. What is commonly called ammonia is more properly ammonia water; that is, water with several hundred times its volume of ammonia gas dissolved in it. But in ice making anhydrous ammonia is used—ammonia free from water. By all processes, which in reality vary but little, the first thing to do is to get the ammonia into liquid form, since by its again becoming vapor the cold is produced. There are two ways of condensing a vapor into a liquid, one being by pressure and the other by cold. It is easiest done by combining these two. After the ammonia is subjected to great pressure it is forced through a coil of pipe where it is cooled by water running over the coil. This coil is small enough to be filled by the ammonia under pressure. To be used so as to exert its cooling effect it is let into pipes larger than the liquid can fill. It immediately vaporizes in these pipes, and they become very cold. If they were carried round and round the walls of a room, or were laid in continuous coils in the walls, the room would become cold, and would remain so while the process was continued, and this would be cold storage.

There are two systems now in common use, with differences in mechanical appliances in each. One is the "compression system," the other the "absorption system." The first is the more common at present, and is that of which the preliminary steps are described above. In this the machinery consists of a powerful pump driven by steam, connected with the condensers, piping, etc. We will suppose that the purpose of this machine is the manufacture of ice to take the place of the natural product in daily use. Liquid ammonia, not the ammonia with water mentioned, but the ammonia liquefied by compression, is the first necessity. This is furnished by the makers of ice machines in strong iron cylinders, or a part of the plant of the ice factory may be devoted to the production of it. This is run into an iron tank, from which it is allowed to pass into the coils of pipe in the freezing tanks. These would be of iron, say twenty by fifty feet in size, and four feet deep. Covering this tank is a floor, which is cut in square holes with rectangular covers. Each of these holds a can which is the size of the block of ice to be frozen in it. The tank contains brine of a regulated strength. This brine is an indispensable of the ice-making process because brine will contain, hold, carry cold, and itself remain unfrozen at the temperature at which water freezes. Its use is familiar in the common process of making ice cream. The square cans stand in this brine, reaching nearly to the bottom of the tank. Across the interior of the tank, passing back and forth, are

the pipes, or the continuous pipe, into which the compressed ammonia has been admitted. Being large enough to contain the ammonia in its gaseous form they become very cold, and the brine surrounding them often reaches a temperature of 15° or 18° Fahr. This brine in the freezing tank is kept in constant circulation by agitators worked by appropriate machinery, so that all the cans containing water to be frozen may have temperatures alike. In an arrangement of this kind it requires from two and one-half to three days to freeze the water in the cans to a solid clearness.

When frozen it is plain that each can will contain one solid block of clear ice the exact size of its interior. A traveling crane lifts them out one at a time and carries them to one side where a little stream of warm water, or a momentary dipping in a tank of warm water, makes the ice loose enough to slip out. This part of the process may be automatic, or nearly so, and the blocks of ice are then ready for use in the usual way.

But the freezing process must be continuous, and a great portion of the machinery of the plant is devoted to making it so. After expanding in the pipes described, and cooling them and the brine around them, the ammonia, now a gas again, is drawn through a pipe into a great pump. The return stroke of the piston compresses it again, and forces it out through a pipe which leads into a condenser. This condenser also consists of coils of pipe, over which cold water is kept running. After the ammonia becomes again liquefied it is let into the storage tank, where the operation began, let from there again into the coils of freezing pipe, and so the operation goes on continually, with the same ammonia used over and over. Machinery of the best kind is necessary in the performance of this seeming miracle, and it was not until it was produced that the process became economically or commercially possible. It is now a common process. There is a great advantage in thus producing commercial ice. All that is obtained from natural sources, such as frozen ponds, lakes, rivers, etc., is more or less infected with disease germs. The water used in making the artificial ice may be, and usually is, distilled and then condensed, or distilled and filtered, and may be absolutely pure.

Ammonia is not the only gas which is used in making ice. Sulphurous oxide is often employed. This is the suffocating gas which is produced when sulphur is burned. The ice machine using this works in essentially the same way that one using ammonia does, by compression and by using the oxide over and over. In this variety of machine a brine made of some other material than common salt may be used, such as magnesium chloride. There may also be slight differences in engines, compressors, etc. As a matter of fact the details of ice-making machinery vary as they do in all other cases, the essentials, for the purpose to be accomplished, remaining the same.

The other class of ammonia ice-making machines operates on what is called the "absorption system." The operation starts in this case with the fluid usually called ammonia, that is, ammonia-water, alluded to above. This liquid is heated in a boiler, and steam and ammonia-gas are driven off from it together. This mixture, or steam, passes into a receptacle where the steam of the water is condensed, and passes back into the boiler, the ammonia-gas passes on into the condenser. Here it is liquefied by pressure and cold, as described in the former case, except that the pressure is not made mechanically by a piston, but by the expansive force of the vapor that is constantly be-

ing driven out of the boiler. The work then done by it is the same as that in the process first described. After doing its work in the freezing pipes the ammonia is again absorbed by the water it was driven out of at first. The solution of ammonia, ammonia-water, is again used as before. The reabsorption and repeated expulsion gives the name to the process.

COLD STORAGE.—This is the name now given to the use of the ice machine in cooling large rooms where all kinds of perishable goods, meats, fruits, vegetables, etc., are stored, and remain fresh in a changeless temperature so low that decay does not occur. This is now much the most extensive use of the ice machine, and has in recent years proven one of the most useful and economical of all industrial improvements. No ice is in this case made. If an extensive coil of pipes in a tank may be made so cold that the brine around may be made to freeze water in cans, it is manifest that the same pipes must absorb the heat from air which is in contact with them, and make it cool. These pipes may be coiled in immense length around the sides of a warehouse, as they were in the tank, and all the air coming in contact will be gradually cooled as the brine was. This, in its simplest terms, is cold storage. There are different systems, varying in detail but not in principle. Machines are now extensively used in steamers for the purpose of preserving fresh meat in voyages of thousands of miles. Small machines are constructed to cool rooms in hospital wards, and many have been made to cool the chambers in hotels just as steam-pipes in winter warm them. The plan is entirely practicable for the dwellings of people whose means enable them to maintain the plant, and as time passes the process must be simplified and cheapened.

One of the surprising results of the refrigeration development has been in engineering. It was first used by a German engineer in 1883, and the process consists in freezing quicksands, loose wet gravel, and even water, so that it may be dug with a pick and thrown out. This, it will be seen, obviates the necessity of sinking caissons, of piping shafts, of lining tunnels, as they are made. The work, in sinking a shaft, consists in driving down pipes about eight inches in diameter in a circle around the place of the intended excavation. Brine which has been made very cold, say to zero, Fahr., is sent down through a pipe which is inside the outer and large pipe, returning through the space between the inner and outer pipes. By this means a circle of frozen water, quicksand, or wet gravel is made, which may be excavated, and a lining put in place. This is a quick solution of one of the standing difficulties in tunneling, mining, and bridge-building.

ICEBERG, a floating mass of ice, which has broken off from such ice sheets as cover Greenland, Spitzbergen, and other polar lands, constituting vast glacier systems ever creeping out and down from the central heights to the shores. As the glacier is pushed out to sea, the lower margin is exposed to the destructive action of the waves, and breaks up into fragments of endless variety of form. These severed blocks, many of which are hundreds of millions of tons in mass, drift to lower latitudes under the influence of polar currents, and gradually melt away in the warmer water. Such is the natural history of icebergs, which, in their freshwater origin, are to be distinguished from the ice fields, ice floes, pack ice, and ice hummocks, so familiar to the polar voyager. The iceberg, as it drifts along, melts most rapidly under water; and this unequal wasting must be accompanied by a change in the position of the center of the mass and

a consequent shifting of the iceberg into its new position of equilibrium. Undermining and fracture also result; so that at length the mass of ice, however square-shaped or symmetrical it may have been originally, assumes a form irregular and fantastic in the extreme. The densities of ice and sea-water are nearly .92 and 1.03 respectively, so that only $\frac{11}{103}$ or nearly $\frac{1}{9}$ of the iceberg is above water and visible. An iceberg observed by Sir John Ross and Lieutenant Parry was $2\frac{1}{2}$ miles long, $2\frac{1}{5}$ miles broad, and 153 feet high. Assuming the form to have been approximately a cone erected upon an elliptic base, the mass above water would be roughly 150,000,000 tons—giving a total mass of nearly 1,500,000,000 tons. This iceberg, however, was by no means of extraordinary dimensions. In the southern seas, great fleets of icebergs have been observed as far north as the latitude of Cape Horn; and some of these ice masses have towered to a height of 700 or 800 feet. The limiting latitude to which icebergs drift is lower in the southern than in the northern hemisphere, probably because of the comparative scarcity of land in the south polar regions.

ICE-HOUSE. An ice-house, to supply ice for domestic use during the summer months, is one of the desirable adjuncts of a country residence. The old form of ice-house was a well several feet deep, dug out on a sloping ground or against a bank. The bottom was made to slope toward a sunk drain, covered by an iron grating, to permit the water from the melted ice to pass away quickly; while a dip in the drain or a bend in the pipe prevented air from entering at the bottom of the well. The ice was filled in through an opening in the dome, which had to be carefully closed.

The Americans, who use large quantities of ice, commonly store it above ground. The house may be twelve feet square, or any larger size. A series of posts in pairs are set up one and one-half feet apart and eight feet high, about one foot being inserted firmly in the ground; the distance between each pair is three feet. The tops being cut level all round, a plate six inches wide and four to six inches deep is spiked on to each line of posts, the two plates being strongly stayed by cross pieces so as to form a double frame. The inner face of each line of posts is now boarded up closely, leaving a space six and one-half feet by three feet at the sides, which are also boarded, to form a door-casing on each side. The spaces between the two lines of boards thus form a continuous box, which is to be completely filled up with moist tan-bark or sawdust well packed throughout. There must be a drain to carry off all water from the interior. Within the inclosed space some level joists are laid down, and on them loose planks to form a floor, which, when covered one foot thick with straw is ready to receive the ice. The roof is formed of rafters, four inches by three, long enough to project at least four feet outside the plates, to which they must be well secured by spikes. The rafters are to be boarded over and covered with shingle, and a small opening left at the top to admit a pipe eight inches in diameter for a ventilator, over which a small ornamental cap, supported on four little posts, is to be placed. As a finish to the projecting roof, brackets of three by four-inch scantling, if the joists are of sawed stuff, or of rough limbs of trees to match the posts, if these are rough, may be introduced. After the ice is stored, a close floor of boards should be laid on joists, resting loosely on the wall plate (to admit of this upper floor being removed while the house is being filled), and they must be covered with six inches of tan or sawdust, or, failing these, with straw. A good layer of tan or sawdust should also be placed on the top of the ice when it is put in. There should be two doors, inside and outside the lining, both opening outward.

A shady place is desirable, but not essential. The enormous warehouses for the storage of ice sold in summer in American cities by the firms dealing in the commodity consist of buildings on these principles, the essential points being the exclusion (as far as possible) of air and the maintenance of uniform interior temperature.

ICELAND (in Danish, *Island*) is an island in the North Atlantic Ocean, immediately to the south of the polar circle. Its distance from the north of Scotland is 500 miles, from Norway 600 miles, and from Greenland 250 miles. The greatest length of the island is 300 miles, from east to west, and its greatest breadth 200 miles. The area is estimated at 40,300 square miles, 7,000 more than that of Ireland.

The geological formation of the island is throughout volcanic. The whole island seems to have been filled up by volcanic agency. In some of the mountains the lavas occur in tolerably regular parallel strata or terraces, separated here and there by layers containing lignite, as in the similar volcanic plateaus of Faroë and Greenland.

The whole of the south coast, from Hornafjörour in southeast to Reykjanes in the southwest, is entirely unbroken by bays or firths. If such ever existed, they have been filled up by the glaciers and the sand and mud carried down from the volcanic ice-mountains situated close to the south coast. The coast line is not, however, a straight line, but a broad arch, as the land swells out in the middle southward to a considerable extent.

The center of the island is a table land, or rather a broad flattened ridge, sloping down to the north and south, the average height of which above the level of the sea is about 2,000 feet.

The southern and part of the eastern coasts of Faxaflói, as far as Reykjavík, are very barren and desolate, being almost entirely rugged lava tracts; but the lower parts of the hills then begin to be clothed with grass, affording pasture for sheep, cattle, and horses. The northwest peninsula consists of narrow firths divided by high and narrow mountain ridges, seldom lower than 2,000 feet. In some places the top is a thin rocky edge; in others it consists of sharp-pointed peaks, denuded of all vegetation. Even at a considerable distance the different rocky strata may be distinguished. Sometimes these hills, or rather cliffs, rise perpendicularly out of the water to a height of a couple of thousand feet, affording breeding-places to an immense number of sea-fowl. More frequently the lower parts of these razor-backed hills slope toward the firths, the stony slopes being partly covered with grass or heather. The farms are therefore found along the shores and in short valleys cutting into the hills from the ends of the firths. The east coasts of Iceland present exactly the same character as that of the northwest peninsula. From the end of Eyafjörour a long and fertile valley, bounded on both sides by lofty mountains, runs due south into the country for about twenty-five miles. The northeast corner of the island, called Pingeyarsysla, has good sheep pasturage, although its hills and slopes are covered with heather instead of grass to a greater extent than most other districts of the island. It will thus be seen that the inhabited parts run round the coasts, and from the end of the bays into the interior, the farms farthest inland being about fifty miles from the sea.

As the snow-line is at an altitude of from 2,500 to 3,000 feet, all the highest mountain-tops are cones covered with perpetual snow.

Most of the mountains of Iceland have been volcanoes, and at least twenty-five of them have been active within

the historical period of the island, that is, the last 1,000 years.

Of the existing volcanic mountains the best known is Hecla, from which eighteen eruptions have been recorded; the last took place in 1845-46. The intervals between the eruptions have varied greatly; sometimes it has remained quiet for six years only, at other times for seventy-two years. As with most other volcanoes, the height of this mountain varies with the eruptions. Thus before the eruption of 1845 its height was given on Gunga-*laugsson's* map as 4,951 feet, while *Kjerulf* measured the mountain in 1850, and found it to be only 4,532 feet. The earliest historical eruption, that of 1104, is celebrated as the "sand-rain winter," the second, in 1158, as the "great darkness," from the quantity of ashes ejected. One feature of the Icelandic eruptions, not from Hecla only, but from other orifices in the island, has been the prodigious quantity of fine dust discharged and the great distance to which this material has been carried. Thus in the year 1766 a column of ashes rose out of the crater of Hecla to a height of 16,000 feet into the air. Volcanic dust from the Icelandic vents has frequently been borne by upper air currents so as to fall upon the *Faroë* Islands, and has even been carried in considerable quantities as far as Norway, on the one side, and the north of Scotland, on the other. Next to Hecla, the *Katla*, or *Kötlugjá*, in *Myrdalsjökull* may be mentioned; its last eruption (the thirteenth known) took place in 1860. The most tremendous volcanic outbreak in Iceland was that which took place in 1783 in or near the *Skaptárjökull*, on the northwest border of the *Vatnajökull*. Two principal lava streams flowed from it; one of them was fifty miles in length, from twelve to fifteen miles in breadth, and 100 feet deep, and the other was forty miles in length. It has been calculated that these two streams cover an area of 420 square miles. This eruption destroyed, directly or indirectly, one-sixth of the inhabitants of the whole island, and one-half of all the live stock. From nearly all the outliers of the *Vatnajökull* eruptions now and then take place. To the north of *Vatnajökull* a range of volcanic centers extends as far as *Myvatn*. The last outbreak here took place in 1875, when fine volcanic dust was discharged in great quantity, some of it being carried as far as Norway. The sea around the coasts of Iceland has been frequently disturbed by volcanic outbreaks, especially off *Cape Reykjanes*.

On account of the same volcanic activity, hot springs are frequently met with throughout the island. The common name for them in Icelandic is "*hverr*" (caldron). The chief of these hot springs is *Geysir* (Gusher). (See *GEYSERS*.)

The only mineral worked to any extent in Iceland is sulphur; the principal mines are those of *Krísuvík* and *Myvatn*.

Iceland is rich in streams and rivers, some of them carrying a large volume of water; as, however, the fall is steep in every case, they are not navigable even by small boats.

The climate of Iceland is not nearly so severe as might be supposed from the latitude. One feature in the climate has been noticed by all travelers, that is, the clearness and purity of the atmosphere, rivaling that of Italy, mountains being seen distinctly at a distance of 100 miles. The rainfall is considerable in the south and the east of the island, and snowstorms and gales are frequent in winter. Thunderstorms occur mostly in winter.

No cereal is grown in Iceland, but in some places there is found a kind of wild oats, called in Icelandic "*melur*." Potatoes, carrots, turnips, and several kinds of cabbage have lately been cultivated with consider-

able success. The grasses, wild and cultivated, are of the greatest importance to the inhabitants. The only trees found are the dwarf birch, rarely higher than twelve feet, and some willow and juniper bushes. The wild flora of Iceland is small and delicate, with bright bloom, the heaths being especially admired. Wild crowberries and bilberries are the only kind of fruit found in the island.

The only wild animal in Iceland is the fox, of which both white and blue varieties occur; they are hunted for their skins, and also because they often attack the sheep. The domestic animals are the cow, the horse, the sheep, the dog, and the cat. The cows are of a small breed, resembling English shorthorns in general, and especially *Alderneys*. The horses are also of a small breed, the average height being twelve hands; they are hardy and enduring; many of them are never housed, and forage for themselves as best they can throughout the winter. They are exported to Great Britain in considerable numbers, for use in the coal mines. The sheep generally are of nearly the same size as the Scotch black-faced sheep; they are not infrequently seen with three or four horns. The genuine Iceland dog, with his pointed snout, short ears, curled tail, and short legs, has some resemblance to the *Esquimaux* dog and the Scotch collie. Reindeer were imported in the last century, but they fled to the mountains and became wild; they are now nearly extinct. There are said to be ninety different species of birds, fifty-four of them being water-fowl. The most remarkable of the birds of prey are the Icelandic falcon (*Falco islandicus*) and the eagle. The only game bird is the ptarmigan, which is brown in summer and white in winter. Of the water-fowl the eider duck is of the greatest importance on account of its valuable down; the killing of it is therefore forbidden by law. Immense numbers of gulls, puffins, and guillemots are seen near their breeding places on the small islands and on the cliffs round the coasts. The hooper, or whistling swan, is found in large numbers in Iceland. The sea round the coast teems with cod, haddock, halibut, and the basking shark; the fin-backed whale and seals of various kinds are also met with, but in smaller numbers. In the lakes and rivers, salmon and trout are caught in considerable quantities.

As no corn is grown, there is no agriculture to speak of, and only a little spade husbandry connected with the cultivation of kitchen gardens, where potatoes, turnips, and carrots are grown. The area thus under cultivation covers, according to the latest official returns, about 215 English acres throughout the island.

The manufactures are confined to spinning, weaving and knitting the wool of the sheep. A sort of tweed is the principal clothing of the inhabitants. The spinning of the yarn is done by the women in winter, and almost every farm has an old-fashioned loom. In the north considerable quantities of jackets and stockings are knitted and exported.

The trade with Iceland is entirely in the hands of Danish traders and a few Icelanders—who mostly reside in Copenhagen. It consists almost entirely in exchange, or barter. The principal exports of the Icelanders are cod fish, about 6,000,000 pounds annually; train oil 9,500 barrels; wool, 1,500,000 pounds; eider down, 7,000 pounds; and feathers, 20,000 pounds. Ponies are now exported to Scotland—about 2,000 a year; and a few cargoes of live sheep have been sent over during the last few years. All bread stuffs have to be imported, as well as groceries, spirits, wines and beer, tobacco, salt, building materials, and other items. Since 1854 the trade has been open to all nations.

There being no roads in the island, but merely tracks trodden down by the feet of the ponies, there are no

carts nor carriages of any description. In the firths boats are chiefly used for conveying goods and passengers; but all inland communication and conveyance are by ponies. These hardy animals carry each a burden of about 200 pounds weight, under which they walk about twenty-five miles a day. All traveling is also on ponies; two are considered necessary for every traveler, and on them he can make from thirty to forty miles a day.

Iceland is subject to the king of Denmark. According to the constitution granted to Iceland in 1874, the king shares the legislative power with the Al-thing, an assembly of thirty-six members, thirty of whom are elected by household suffrage, and six nominated by the king. The Al-thing meets every second year, and sits in two divisions, the upper and the lower. The upper division consists of the six members nominated by the king and six elected by the representatives of the people out of their own body. The lower division consists of the remaining twenty-four representative members.

The administration of justice is carried out in the first instance by the sheriffs. From the sheriff courts appeals lie to the superior court at Reykjavík, consisting of three judges. Appeals may be taken in all criminal cases and most civil cases from this court to the supreme court at Copenhagen.

The state church of Iceland is the Lutheran; and all the Icelanders, without exception, belong to it. One bishop and 141 clergymen minister to the spiritual wants of the islanders. The bishop is appointed by the king. The parishes are 290, but the livings are only 141, from which it may be seen that many ministers have to serve two, and some even three parishes. The king appoints some of the ministers, and the governor-general others, with the advice of the bishop. The ministers are paid partly from the revenues of church property, and partly from tithes.

The Icelanders have long been famous for their education and learning, and it is no exaggeration to say that in no other country is such an amount of information found among the classes which occupy a similar position. A child of ten unable to read is not to be found from one end of the island to another. A peasant understanding several languages is no rarity, and the amount of general information which they possess might be envied by many who have had greater facilities for acquiring knowledge. Till within the last few years there were no elementary schools in the island; all children were taught by their parents or near neighbors. Now a few elementary schools have been started, but their number is still too small to make any general difference in the education. For classical and general education there is a college at Reykjavík, with seven professors and about 100 students. There is also a college for ministers, with three professors. The general physician of the island, assisted by two medical men, gives lectures to medical students; but those who propose to enter the legal profession have to attend the university of Copenhagen.

There is less difference in the material prosperity of the Icelanders than in that of the inhabitants of more advanced countries. One does not find the abject poverty so often seen in large towns and among the agricultural population of some of the most civilized countries of Europe. On the other hand, wealthy men, or owners of extensive properties, are unknown, the richest man in Iceland deriving only £300 a year from his property.

The census of 1870 returned the population of the island as 69,763. In 1801 the population was only 46,240; in 1888 it was found to have increased to 69,224. The birth-rate is about thirty-three per thou-

sand, and the death rate twenty-four. Nearly the whole of the population live on isolated farms, the number of each family, including servants, being on an average seven. The chief town or village is Reykjavík, with about 2500 inhabitants. It is the seat of the governor-general, the bishop, the colleges, and the superior court.

Shortly after the discovery of Iceland by the Scandinavians, c. 850 (it had long been inhabited by a small colony of Irish Culdees), a stream of immigration set in toward it, which lasted for sixty years, and resulted in the establishment of some 4,000 homesteads scattered round the habitable fringe about the great bays and firths.

In this immigration three distinct streams can be traced. (1) About 870-890 four great noblemen from Norway, Ingolf, Ketil Hæng, Skalla-Grim and Thorolf, settled with their dependants in the southwest of the new found land. (2) In 890-900 there came from the Western Islands Queen Aud, widow of Olaf the White, king of Dublin, preceded and followed by a number of her kinsmen and relations (many like herself being Christians), Helgi Biolan, Biorn the Eastern, Helgi the Lean, Ketil the Foolish, etc., who settled the best land in the island (west, northwest, and north), and founded families who long swayed its destinies. Besides this most important immigration of all there came from the Western Islands a fellowship of vikings seeking a free home in the north. They had colonized the west in the viking times; they had "fought at Hafursfirth," helping their stay-at-home kinsmen against the centralization of the great head-king, who, when he had crushed opposition in Norway, sailed after these turbulent colonists across the North Sea, and followed up his victory by compelling them to bow to his rule or fly again to fresh haunts whence they could not so easily interfere with his projects. Such were Ingimund the Old, Geirmund Hellskin, Thord Beardie (who had wed St. Edmund's grand-daughter), Audun Shackle, Bryniulf the Old, Unn, to whom Harold promised the earldom of the new land if he could make the settlers acknowledge him as king, a hopeless project, and others by whom the northwest, north and east were almost completely "claimed." (3) In 900-930 a few more incomers direct from Norway completed the settlement of the south, northeast and southeast. Among them were Earl Hrollaug (half brother of Hrolf Ganger and of the first earl of Orkney), Hialti, Hrafnkel, Frey's priest, and the sons of Asbiorn. Fully three-quarters of the land was settled from the west, and among these immigrants there was no small proportion of Irish blood. In 1100 there were 4,500 franklins, *i.e.*, about 50,000 souls.

The unit of Icelandic politics is the homestead with its franklin-owner (*buendi*), its primal organization the hundred-moot (*thing*), its tie the *goðorð* or chieftainship. The chief who had led a band of kinsmen and dependants to the new land, taken a "claim" there, and parceled it out freely among them, naturally became their leader, presiding as priest at the temple feasts and sacrifices of heathen times, acting as president and speaker of their moot, and as their responsible representative toward the neighboring chiefs and their clients. He was not a feudal lord nor a local sheriff, for any franklin could change his *goðorð* when he would, and the rights of "judgment by peers" were in full use; moreover, the office could be bequeathed, sold, divided, or pledged by the possessor; still the *goði* had considerable power and influence as long as the commonwealth lasted.

At first there was no higher organization, but disputes between neighboring chiefs and their clients, and uncertainty as to the law, brought about the *Constitution*

of *Ulfiot*, c. 930, which appointed a central moot for the whole island, the Al-thing, and a speaker to speak a single "law" (principally that followed by the Gulamoot in Norway); the *Reforms of Thord Gellir*, 964, settling a fixed number of local moots and chieftaincies, dividing the island into four quarters (thus characterized by Ari:—north, thickest settled, most famous; east, first completely settled; south, best land and greatest chiefs; west, remarkable for noble families), to each of which a head-court, the "quarter-court," was assigned; and the *Innovations of Skapti* (ascribed in the saga to Nial) the *Law-Speaker* (d. 1030), who set up a "fifth court" as the ultimate tribunal in criminal matters, and strengthened the community against the chiefs. But here constitutional growth ceased; the law-making body made few and unimportant modifications of custom; the courts were still too weak for the chiefs who misused and defied them; the speaker's power was not sufficiently supported to enable him to be any more than a highly respected lord chief justice, whereas he ought to have become a *justiza* if anarchy was to be avoided; even the ecclesiastical innovations, while they secured peace for a time, provoked in the end the struggles which put an end to the commonwealth.

Christianity was introduced c. 1000. Tithes were established in 1096, and an ecclesiastical code made c. 1125.

The first disputes about the jurisdiction of the clergy were moved by Gudmund in the thirteenth century, bringing on a civil war, while the questions of patronage and rights over glebe and mortmainland occupied Bishop Arni and his adversaries fifty years afterward, when the land was under Norwegian viceroys and Norwegian law. For the civil war of the thirteenth century broke down and exterminated the great houses who had monopolized the chieftaincies and abused their power for their own ends; and after violent struggles (in which the Sturlungs of the first generation perished at Orlygstad, 1238, and Rekiholt, 1241, while of the second generation Thord Kakali was called away by the king in 1250, and Thorgils Skardi slain in 1258) the submission of the island, quarter after quarter, took place in 1262–64, under Gizur's auspices, and the old Common Law was replaced by the New Norse Code "Ironside" in 1271.

The mediæval Icelandic church had two bishoprics, Skalholt (south, west, and east) 1056, and Holar (north) 1106, and about 175 parishes (two-thirds of which belonged to the southern bishopric). The bishops, elected by the people at the Al-thing till 1237, enjoyed considerable power and influence, and were most of them distinguished men; two, Thorlak of Skalholt and John of Holar, were publicly voted saints at the Al-thing after due examination of their claims to that distinction, and one, Gudmund, received the title of "Good" by decree of the bishop and chapter.

Iceland was not agricultural but pastoral, depending upon flocks and herds for subsistence, for, though rye and other grain would grow in favored localities, the hay, self-sown, was the only regular crop. In some districts the fisheries and fowling were of importance, but nine-tenths of the population lived by their sheep and cattle, which gave them food, clothing, and such products for export as enabled them to import wood for building, iron for tools, and a few luxuries, as honey, wine, grain for brewing, and foreign clothes, fur, etc. Life on each homestead was regularly portioned out:—out-door occupations—fishing, shepherding, fowling, and the important hay-making and fuel-gathering—occupying the summer; while in-door business—weaving, tool-making, etc., filled up the long winter. The year was broken by the spring feasts and moots,

the great Al-thing meeting at midsummer, the marriage and arval gatherings after the summer, and the long yule feasts at midwinter. There were but two degrees of men, free and unfree, though only the franklins had any political power; and, from the very nature of the life, social intercourse was peculiarly unrestrained and unfettered; *goði* and thrall lived the same lives, ate the same food, spoke the same tongue, and differed little in clothing or habits. The poorest franklin was the social equal of the proudest chief, and in a few generations the freedman or landless dependant might become their peer in public estimation, provided he got a homestead of his own. The thrall had a house of his own and was rather villein or serf than slave, having rights and a legal price by law. During the heathen days many of the great chiefs passed part of their lives in Norway at the king's court, but after the establishment of Christianity in Iceland they kept more at home, still visiting the Continent, however, for purposes of state, suits with clergy, etc. But the trade was from the first in foreign (Norse) hands almost entirely.

The introduction of a church system brought little change. The great families put their members into orders, and so continued to enjoy the profits of the land which they had given to the church; the priests married and otherwise behaved like the franklins around them in every-day matters, farming, trading, going to law like laymen; so that, in spite of the efforts of the more earnest church reformers, the church was powerless to promote centralization against the feuds and jealousies of the great houses.

The old life in the commonwealth was turbulent and anarchic, but free and varied; it produced men of mark, and fostered bravery, adventure, and progress. The great chiefs were indeed only greater franklins; but their wealth and comparative luxury gave them leisure and opportunities for culture which raised them as examples and leaders above their fellows; the pride of birth preserved a nobility of feeling and high standard of honor amid much of violence and chicane. But all this now ceased, and there was left but a low dead level of poor peasant proprietors without pride in the past, political interest in the present, or ambition of the future, careless of all save how to live by as little labor as possible, and pay as few taxes as they could to their foreign rulers. The island received a foreign governor, and was parceled out into local counties (*sýslur*), administered by sheriffs (*sýslumadr*) appointed by the king. A royal court took the place of the Al-thing courts; the local business of the local things was carried out by the (*hreppstjóri*) bailiff, a subordinate of the sheriff; and the *goðod*, things, quarter-courts, trial by jury, etc., were all completely swept away by these innovations, which have continued with mere changes of detail till the present century. The power of the crown was increased by the confiscation of the great Sturlung estates, which were under-leased to farmers, while the early falling off of the Norse trade threatened to deprive the island of the means of existence; for the great epidemics and eruptions of the fourteenth century had gravely attacked its pastoral wealth and ruined much of its pasture and fishery, for the time at least. The union of the Three Crowns transferred the practical rule of Iceland to Denmark in 1280, and the old Treaty of Union, by which the island had reserved its essential rights, was disregarded by the absolute Danish monarchs; but, though new taxation was imposed, it was rather their careless neglect than their too active interference that damaged Iceland's interests. But for an English trade, which sprung up out of the half-smuggling, half-buccaneering enterprise of the Bristol merchants, the island would have fared badly indeed, for during the

whole fifteenth century their trade with England, exporting sulphur, eider down (which the English taught them the value of), wool, and salt stock-fish, and importing as before wood, iron, honey, wine, grain, and flax goods, was their only link with the outer world. This period of Iceland's existence is torpid and eventless; she had got peace, but with few of its blessings; all spirit seemed to have died with the commonwealth; even shepherding and such agriculture as there had been sank to a lower stage; wagons, plows and carts went out of use and knowledge; architecture in timber became a lost art, and the fine carved and painted halls of the heathen days were replaced by turf-walled barns half sunk in the earth, and lasting at best a generation; the large, decked luggers of the old days gave way to small, undecked fishing-boats; it is needless to add that letters were neglected, and that all remembrance of the commonwealth perished utterly.

The Reformation here as elsewhere had a one-sided effect: it wakened men's minds, opening new vistas of hope and new fields of thought, but it left their bodies and circumstances little changed, or, if at all, for the worse. Its necessary complement, a social and political revolution, never came to Iceland. The Hanse trade replaced the English for the worse; and the wretched Danish monopoly which succeeded it when the Danish kings began to act again with vigor, under the stimulus of European changes, was still less profitable. The glebes and hospital lands were a fresh power in the hands of the crown, and the subservient Lutheran clergy became the most powerful class in the island, while the bad system of under-leasing at rackrent and short lease with unsecured tenant right extended in this way over a great part, at least a quarter, of the better land, stopping any possible progress. The details of the religious change are uninteresting; nearly all who took active part in it on either side were men of low type, moved by personal motives rather than religious zeal; and though it should be noticed that the fires of martyrdom were never lighted in Iceland, the story of the easily accepted Reformation is not altogether a pleasant one. When it was once accomplished, the little knot of able men who came to the front for two or three generations, stirred by the new life that had been breathed into the age, did nobly in preserving the records of the past for a later time to value and appreciate, while Odd and Hallgrim exhibit the noblest impulses of their time.

A new plague, that of the English, Gascon, and Algerine pirates, marked the close of the sixteenth century and opening of the seventeenth, causing widespread panic and some devastation in 1579, 1613-16, and 1627. Nothing points more to the helplessness of the natives' condition than their powerlessness against these tire-some foes. But the eighteenth century is the most gloomy in Iceland's annals. Smallpox, famine, sheep disease, and the awful eruptions of 1765 and 1783 follow each other in terrible succession. Against such fearful visitations, which reduced the population by about a fourth, little could be done, and when the only man who might have roused the Icelanders from their misery, distress, and impoverishment, the noble and patriotic Eggert Olafsson, a hero of the old type, was drowned in full career in 1768, it is hardly to be wondered at that things grew from bad to worse, and that a listlessness and torpidity crept over the national character, the effects of which it is only beginning to shake off. The few literary men, whose work was done and whose books were published abroad, were only concerned with the past, and Jon Widalin is the one man of mark, beside Eggert Olafsson, who worked and wrote for his own generation.

Gradually the ideas which were agitating Europe crept

through Scandinavia into Iceland, and, now that scholars and travelers of mark and influence had drawn attention to the island, its claims were more respectfully listened to. The Continental system, which, by its leading to the blockade of Denmark, threatened to starve Iceland, was neutralized by special action of the British Government. Trade and fishery grew a little brisker, and at length the turn came.

The rationalistic movement, an unlovely attempt at reform, headed by Magnus Stephenson, a patriotic, narrow-minded lawyer, did little good as far as church reform went, but was accompanied by a more successful effort to educate the people by means of bringing within their reach the practical knowledge of the day. A Useful Knowledge Society, such as Brougham delighted in, was formed and did some honest work. Newspapers and periodicals were published, and the very stir which the ecclesiastical disputes encouraged did good. When free trade came, and when the free constitution of Denmark had produced its legitimate effects, the intelligent and able endeavors of a few patriots such as Jon Sigurdsson were able to push on the next generation a step further, in spite of such physical obstacles as the sheep disease. Questions of a modern political complexion arose; the cattle export controversy and the great home rule struggle began. The intelligence of a people whose love for knowledge and mental attainments has always been high, seconded its leaders well, and after thirty years' agitation home rule was conceded in 1874. The absolute *systemadr* and *hirdstjori* became popular officials assisted by elected boards. The *Al-thing*, a mere council of powerless delegates, was replaced by a representative assembly of two chambers (composed of thirty members chosen by a popular and wide suffrage, and six crown nominees) with legislative powers, and other reforms were comprised in this grant. Further political changes, such as the introduction of a jury system to replace the Danish umpire-and-assessor procedure, are now being considered by the liberal party. There are many peculiar circumstances present in the condition of Iceland, the absence of towns, equality of society in a sense which exists in no other European community, difficulty of communication, and the intense conservatism and dislike of activity or change which must necessarily characterize a community so long isolated and "forced into lazy habits for lack of opportunity." But that emigration should have begun, and families left the old home for Canada and the United States to seek a better climate, a richer soil, and the hopes of progress which are so distant at home, is certainly remarkable; and, if the difficulties which must surround emigrants who have never seen a road, a tree, or a plow, on their first taking up an agricultural life, are overcome, the results may be very important to the mother country.

ICELAND MOSS, a lichen, *Cetraria islandica* (Achar.), whose erect or ascending foliaceous habit gives it something of the appearance of a moss, whence probably the name. The thallus has a pale chestnut color, and grows to a height of from three to four inches, the branches being channeled or rolled into tubes, which terminate in flattened lobes with fringed edges. It grows abundantly in the mountainous regions of northern countries, and especially it is characteristic of the lava slopes and plains of the west and north of Iceland. As met with in commerce it is a light-gray harsh cartilaginous body, almost destitute of odor, and having a slightly bitter taste. It contains about 70 per cent. of lichenin or lichen-starch, a body isomeric with common starch, but wanting any appearance of structure. It also yields a peculiar modification of chlorophyll, called thallochlor, fumaric acid, lichenostearic acid, and cetraric acid, to

which last it owes its bitter taste. In medicine it is used as a mild tonic, and at the same time it forms a nutritious and easily digested amylaceous food, being used in place of starch in some preparations of cocoa. It is not, however, in great request; and even in Iceland it is only habitually resorted to in seasons of scarcity.

I-CHANG, or Y-CHANG, also called Y-LIN in some maps, a town of China, in the province of Hoo-pih, one of the four new ports opened to foreign trade by treaty in 1877. Population, 35,375.

ICHNEUMON (*Herpestes*), a genus of small carnivorous mammals belonging to the family *Viverridae*, and resembling the true civets in the elongated weasel-like form of the body and in the shortness of the limbs. There are, according to Gray, twenty-two species of ichneumons, the great majority of which are confined to the African continent, the remainder occurring in Persia, India, and the Malay archipelago, and one, the Andalusian ichneumon, in the Sierra Morena of Spain, the last probably an African straggler. The Egyptian and Indian ichneumons are the forms best known. The former is an inhabitant of Egypt and the north of Africa, where it is known to foreign residents as "Pharaoh's rat." When full grown it is about the size of the domestic cat. It is covered with a fur of long harsh hairs of a tawny gray color, darker on the head and along the middle of the back, its legs reddish and its feet and tail black. It feeds on rats and mice, birds and reptiles, and for this reason is occasionally domesticated. Its fondness for eggs leads it to search for those of the crocodile, buried as these usually are beneath a thin covering of sand on the river banks; and its services in thus checking the multiplication of those reptiles were so appreciated by the ancient Egyptians that they regarded the ichneumon as a sacred animal, and when it died buried it, says Herodotus "in holy repositories." The Indian ichneumon or mungoos is considerably smaller than the Egyptian form; its fur is of a pale gray color, the hairs being largely white-ringed, while the cheeks and throat are more or less reddish. Like the preceding species, it is frequently domesticated, and is then put to a similar use. It is especially serviceable in India as a serpent killer, destroying not only the eggs and young of these creatures, but attacking without hesitation and killing the most venomous adult snakes. The fact that it invariably survives those encounters has led to the belief that it either enjoys immunity from the effects of snake poison, or that after being bitten it has recourse, as the Hindoos have always maintained, to the root of a plant as an antidote. Neither of these suppositions has stood the test of scientific examination, for it has been found that when actually bitten it falls a victim to the poison as rapidly as other animals, while there is no trustworthy evidence of its seeking a vegetable antidote. The truth seems to be that the mungoos by its exceeding agility and quickness of eye avoids the fangs of the snake while fixing its own teeth in the back of the reptile's neck. The whole Thanatophidia of India stand in awe of this tiny but tenacious mammal, and seek to escape from its presence. The mungoos, on the other hand, never hesitates to attack.

ICHNEUMON-FLY is a general name applied to parasitic insects of the section *Pupivora* (or *Entomophaga*), order *Hymenoptera*, from the typical genus *Ichneumon*, belonging to the chief family of that section—itsself fancifully so called after the Egyptian mammal (*Herpestes*), notorious for its habit of destroying the eggs of reptiles. The species of the families *Ichneumonidae*, *Braconidae*, *Evaniidae*, *Proctotrypidæ*, and *Chalcididae* are often indiscriminately called "Ichneumons," but the term is perhaps properly applicable

only to the first and second of these, which are respectively equivalent to the *Ichneumones genuini* and *I. adsciti* of older naturalists, chiefly differing in the former having two recurrent nerves to the anterior wing while the latter has only one such nerve. The *Ichneumonidae* proper are one of the most extensive groups of insects, and have been much studied by entomologists since the time of Linnæus and Gravenhorst. Their sexual differences of color, etc., are, however, often so great that fresh discoveries are constantly being made with regard to their true specific relations, as well as new species detected by biological observers. There are six subfamilies of the *Ichneumonidae*, viz., the *Ichneumonides*, *Cryptides*, *Agriotypides*, *Ophionides*, *Tryphonides*, and *Pimplides*, differing considerably in size and facies, but united in the common attribute of being in their earlier stage parasitic upon other insects. They have all long, narrow bodies; a small free head with long filiform or setaceous antennæ, which are never elbowed, and have always more than sixteen joints; the abdomen attached to the thorax at its hinder extremity between the base of the posterior coxæ, and provided in the female with a straight ovipositor often exerted and very long; and the wings veined, with perfect cells on the disk of the front pair.

The parasitic habits above alluded to render these flies of very great importance in the economy of nature, as they effectually serve to check any inordinate increase in the numbers of injurious insects. Without their aid, indeed, it would in many cases be impossible for the agriculturist to hold his own against the ravages of his minute hexapod foes, whose habits are not sufficiently known to render artificial checks or destroying agents available. The females of all the species are constantly on the alert to discover the proper living food for their own larvæ, which are hatched from the eggs they deposit in or on the eggs, larvæ, or pupæ of other insects of all orders, chiefly *Lepidoptera*, the caterpillars of butterflies and moths being specially attacked (as also are spiders). Anyone who has watched insect life, even in a suburban garden, during summer, can hardly have failed to notice the busy way in which the parent ichneumon, a small, four-winged fly, with constantly vibrating antennæ, searches for her prey; and the clusters of minute cocoons around the remains of some unfortunate cabbage-butterfly caterpillar, which has had just enough vitality left in it to crawl instinctively to a proper place for undergoing that change to pupa which it will never make, must also have been observed by many. This is the work of *Apanteles* (or *Microgaster*) *glomeratus*, one of the *Braconidae*, which in days past was a source of disquietude to naturalists, who believed that the life of the one defunct larva had *transmigrated* into the numerous smaller flies reared from it.

ICHTHYOLOGY is that branch of zoölogy which treats of the internal and external structure of fishes, their mode of life, and their distribution in space and time. According to the views generally adopted at present, all those Vertebrate animals are referred to the class of Fishes which combine the following characteristics: They live in water, and by means of gills or branchiæ breathe air dissolved in water; the heart consists of a single ventricle and single atrium; the limbs, if present, are modified into fins, supplemented by unpaired median fins; and the skin is either naked, or covered with scales or with osseous plates or bucklers. With few exceptions fishes are oviparous. There are, however, not a few members of this class which show a modification of one or more of these characteristics, and which, nevertheless, cannot be separated from it. The distinction between the class of Fishes and that of Batrachians is very slight indeed.

The commencement of the history of ichthyology coincides with that of zoölogy generally. Aristotle (384–322 B.C.) had a perfect knowledge of the general structure of fishes, which he clearly discriminates both from the aquatic animals with lungs and mammæ, *i.e.*, Cetaceans, and from the various groups of aquatic invertebrates. According to him, “the special characteristics of the true fishes consist in the branchiæ and fins, the majority having four fins, but those of an elongate form, as the eels, having two only. Some, as the *Muræna*, lack the fins altogether. The rays swim with their whole body, which is spread out. The branchiæ are sometimes furnished with an operculum, sometimes they are without one, as in the cartilaginous fishes. * * * No fish has hairs or feathers; most are covered with scales, but some have only a rough or a smooth skin. The tongue is hard, often toothed, and sometimes so much adherent that it seems to be wanting. The eyes have no lids, nor are any ears or nostrils visible, for what takes the place of nostrils is a blind cavity; nevertheless they have the senses of tasting, smelling, and hearing. All have blood. All scaly fishes are oviparous, but the cartilaginous fishes (with the exception of the sea-devil, which Aristotle places along with them) are viviparous. All have a heart, liver, and gall-bladder; but kidneys and urinary bladder are absent. They vary much in the structure of their intestines; for, while the mullet has a fleshy stomach like a bird, others have no stomachic dilatation. Pyloric cæca are close to the stomach, and vary in number; there are even some, like the majority of the cartilaginous fishes, which have none whatever. Two bodies are situated along the spine, which have the function of testicles; they open toward the vent, and are much enlarged in the spawning season. The scales become harder with age. Not being provided with lungs, fishes have no voice, but several can emit grunting sounds. They sleep like other animals. In most cases the females exceed the males in size; and in the rays and sharks the male is distinguished by an appendage on each side of the vent.”

Aristotle's information on the habits of fishes, their migrations, mode and time of propagation, and economic uses, is, so far as it has been tested, surprisingly correct. Unfortunately, we too often lack the means of recognizing the species of which he gives a description. His ideas of specific distinction were as vague as those of the fishermen whose nomenclature he adopted; it never occurred to him that vernacular names are subject to change, or may be entirely lost in course of time, and the difficulty of identifying his species is further increased by the circumstance that sometimes several popular names are applied by him to the same fish, or different stages of growth are designated by distinct names. The number of fishes known to Aristotle seems to have been about one hundred and fifteen, all of which are inhabitants of the Ægean Sea.

That one man should have discovered so many truths, and laid so sure a basis for future progress in zoölogy, is less surprising than the fact that for about eighteen centuries a science which seemed to offer particular attractions to men gifted with power of observation was no farther advanced. Yet such is the case. Aristotle's disciples, as well as his successors, remained satisfied to be his copiers or commentators, and to collect fabulous stories or vague notions. With very few exceptions (such as Ausonius, who wrote a small poem, in which he describes from his own observations the fishes of the Moselle) authors entirely abstained from original research; and it was not until about the middle of the sixteenth century that ichthyology made a new step in advance by the appearance of Belon, Rondelet, and Salviani, who almost simultaneously published

their great works, by which the idea of species was established definitely and for all time.

Without enumerating in detail the many eminent authorities since the time of the three mentioned, we will proceed at once to consider the science in the light of its teachings.

EXTERNAL PARTS.

In the body of a fish four parts are distinguished — the head, trunk, tail, and fins; the boundary between the first and second is generally indicated by the gill-opening, and that between the second and third by the vent. The form of the body and the relative proportions of these principal parts are subject to greater variation than is to be found in any other class of vertebrates. In fishes which are endowed with the power of steady and more or less rapid locomotion, a deviation from that form of body which we observe in a perch, carp, or mackerel is never excessive. The body is a simple, equally-formed wedge, compressed or slightly rounded, well fitted for cleaving the water. In fishes which are in the habit of moving on the bottom, the whole body, or at least the head, is vertically depressed and flattened; and the latter may be so enormously enlarged that the trunk and tail appear merely as an appendage. In one family of fishes, the *Pleuronectidæ* or flat-fishes, the body is compressed into a thin disk; they swim and move on one side only, which remains constantly directed toward the bottom, a peculiarity by which the symmetry of all parts of the body has been affected. In fishes moving comparatively slowly through the water, and able to remain (as it were) suspended in it, a lateral compression of the body, in conjunction with a lengthening of the vertical and a shortening of the longitudinal axis, is found. This deviation from the typical form may proceed so far that the vertical axis greatly exceeds the longitudinal in length; generally all the parts of the body participate in this form, but in one kind of fish (the *Orthogoriscus* or sun-fish) it is chiefly the tail that has been shortened, that being reduced so much as to present the appearance of being cut off. An excessive lengthening of the longitudinal axis, with a shortening of the vertical, occurs in eels and eel-like fishes, and in the so-called band-fishes. They are bottom-fish, capable of insinuating themselves into narrow crevices and holes. The form of the body in these long fishes is either cylindrical (snake-like), as in the eels and many codfishes, or strongly compressed, as in the band-fishes, (*Trichiurus*, *Regalecus*, etc.) It is chiefly the tail that is lengthened, but frequently the head and trunk participate more or less in this form. Every possible variation occurs between these and other principal types of form. The old ichthyologists, even down to Linnæus, depended in great measure on them for classification; but, although the same form of body often obtains in the same groups of fishes, similarity of form by no means indicates natural affinity; it only indicates similarity of habits and mode of life.

The External Parts of the Head.—The eye divides the head into the ante-orbital and post-orbital portions. In most fishes, especially in those with a compressed head, it is situated on the side and in the anterior half of the length of the head; in many others, chiefly those with a depressed head, it is directed upward, and sometimes situated quite at the upper side; in a very few, the eyes look obliquely downward. In the flat fishes both eyes are on the same side of the head, either the right or the left, always on that which is directed toward the light, and colored.

Fishes in general, as compared with other Vertebrata, have large eyes. Sometimes these organs are enormously enlarged, indicating either that the fish is nocturnal

in its habits, or lives at a depth to which only a part of the sun's rays penetrate. On the other hand, small eyes occur in fishes inhabiting muddy places, or great depths, to which scarcely any light descends, or in fishes in which the want of an organ of sight is compensated by the development of other organs of sense. In a few fishes, more particularly those inhabiting caves or the greatest depths of the ocean, the eyes have become quite rudimentary and hidden under the skin.

In the ante-orbital portion of the head, or the snout, are situated the mouth and nostrils.

The mouth is formed by the intermaxillary and maxillary bones or the intermaxillary only in the upper jaw, and by the mandibular bone in the lower. These bones are either bare or covered by integument, to which frequently labial folds or lips are added. As regards form, the mouth offers as many variations as the body itself, according to the nature of the food, and the mode of feeding. It may be narrow, or extremely wide and cleft nearly to the hind margin of the head; it may be semi-elliptical, semi-circular, or straight in a transverse line; it may be quite in front of the snout (anterior), on its upper surface (superior), on its lower (inferior), or extending along each side (lateral); sometimes it is sub-circular, organized for sucking. The jaws of some fishes are modified into a special weapon of attack (sword-fish, saw-fish); in fact, throughout the whole class of fishes the jaws are the only organ ever specialized for this purpose, weapons on other parts of the body being purely defensive.

Both jaws may be provided with skinny appendages, barbels, which, if developed and movable, are sensitive organs of touch.

In the majority of fishes the nostrils exhibit a double opening on each side of the upper surface of the snout, the openings of each side being more or less close together. They lead into a shallow groove, and only in one family (the Myxinoids) perforate the palate. In this family, as well as in the lampreys, the nasal aperture is single. In many eels the openings are lateral, the lower perforating the upper lip. In the sharks and rays they are at the lower surface of the snout, and more or less confluent. And, finally, in the Dipnoi and other Ganoids, one at least is within the labial boundary of the mouth.

The space across the forehead, between the orbits, is called the interorbital space; that below the orbits, the infraorbital or suborbital region.

In the postorbital part of the head there are distinguished, at least in most Teleosteous fishes and many Ganoids, the præoperculum, a sub-semi-circular bone, generally with a free and often serrated or variously armed margin; the operculum, forming the posterior margin of the gill opening; and the suboperculum and the interoperculum along its inferior margin. All these bones, collectively called opercula, form the gill cover, a thin bony lamella covering the cavity containing the gills.

The gill-opening is a foramen, or slit, behind or below the head, by which the water that has been taken up through the mouth for the purpose of breathing is again expelled. This slit may extend from the upper end of the operculum all round the side of the head to the symphysis of the lower jaw; or it may be shortened and finally reduced to a small opening on any part of the margin of the gill-cover. Sometimes (*Symbranchus*) the two openings, thus reduced, coalesce, and form what externally appears as a single opening only. The margin of the gill-cover is provided with a cutaneous fringe, in order more effectually to close the gill-opening; and this fringe is supported by one or several or many bony rays, the branchiostegals. The space on the chest be-

tween the two rami of the lower jaw and between the gill-openings is called the isthmus.

The sharks and rays differ from the Teleosteous and Ganoid fishes in having five branchial slits (six or seven in *Hexanchus* and *Heptanchus*), which are lateral in the sharks, and at the lower surface of the head in the rays. In the *Myxine* only the gill-opening is at a great distance from the head; in that family (*Cyclostomi*) it is either single or there are six or more on each side as in the lampreys.

The Trunk and Tail.—In the trunk are distinguished the back, sides and abdomen. It gradually passes in all fishes into the tail, the termination of the abdominal cavity and the commencement of the tail being generally indicated by the position of the vent. The exceptions are numerous; not only may certain abdominal organs, such as the sexual, extend to between the muscles of the tail, but the intestinal tract itself may pass far backward, or it may even be reflected forward, so that the position of the vent may be either close to the extremity of the tail or to the foremost part of the trunk.

In many fishes the greater part of the tail is surrounded by fins, leaving finless only a small portion between the dorsal, caudal and anal fins; this finless part is called the free portion or the peduncle of the tail.

The Fins.—The fins are divided into vertical or unpaired, and horizontal or paired fins. Any of them may be present or absent; and their position, number, and form are most important guides in determining the affinities of fishes.

The vertical fins are situated in the median dorsal line, from the head to the extremity of the tail, and in the ventral line of the tail. In fishes in which they are least developed or most embryonic, the vertical fin appears as a simple fold of the skin surrounding the extremity of the tail. In its further progress of development in the series of fishes, it gradually extends further forward, and it may reach even the head and the vent. In this embryonic condition the fin is generally supported by fine rays, which are the continuations of, or articulated to, other stronger rays supported by the processes or apophyses of the vertebral column. This form of the vertical fin is very common—for instance in the eels, and many Gadoid, Blennioid, and Ganoid fishes, in which the rays have ceased, besides, to be simple rods, showing more or less numerous joints (simple articulated rays). Branched rays are dichotomously split, the joints increasing in number toward the extremity.

The continuity of the vertical fin, however, is interrupted in the majority of fishes, and three fins are then distinguished: one in the dorsal line—the dorsal fin; one in the ventral line behind the anus—the anal fin; and one confined to the extremity of the tail—the caudal fin.

The caudal fin is rarely symmetrical so that the upper half is equal to the lower; the greatest degree of asymmetry obtains in fishes with a heterocercal termination of the vertebral column. In fishes in which it is nearly symmetrical it is frequently prolonged into an upper and lower lobe, its hind margin being concave or more or less deeply excised; in others the hind margin is rounded, and, when the middle rays greatly exceed in length the outer ones, the fin assumes a pointed form.

Many and systematically important differences are observed in the dorsal fin, which is either spiny-rayed (spinous) (*Acanthopterygian*), or soft-rayed (*Malacopterygian*). In the former, a smaller or greater number of the rays are simple and without transverse joints; they may be flexible, or so much osseous matter is deposited in them that they appear hard and truly spinous; these spines form always the anterior portion of the fin,

which is either detached from, or continuous with, the remaining jointed rays. The spines can be erected or depressed at the will of the fish; if in the depressed position the spines cover one another completely, their points lying in the same line, the fish is called homacanth; but if the spines are asymmetrical, alternately broader on one side than on the other, the fish is called heteracanth. The spinous division, as well as the one consisting of jointed rays, may again be subdivided. In the Malacopterygian type all the rays remain jointed; indeed, sometimes the foremost ray, with its preceding short supports, is likewise ossified, and is a hard spine, but the articulations can nearly always be distinctly traced. Sometimes the dorsal fin of Malacopterygian fishes is very long, extending from the head to the end of the tail; sometimes it is reduced to a few rays only; and in a few cases it is entirely absent. In addition to the rayed dorsal fin, many Malacopterygian fishes (as the Salmonoids, many Siluroids, Scopeloids, etc.) have another of greater or lesser extent, without any rays; and as fat is always deposited within this fold, it is called a fatty fin (*pinna adiposa*).

The anal fin is built on the same plan as the dorsal; it may be single, or there may be more than one; it may also be long or short, or entirely absent; in Acanthopterygians its foremost rays are frequently simple and spinous.

The horizontal or paired fins consist of two pairs, the pectorals and ventrals.

The pectoral fins (with their osseous supports) are the homologues of the anterior limbs of the higher Vertebrata. They are always inserted immediately behind the gill-opening—either symmetrical, with a rounded posterior margin, or asymmetrical, with the upper rays longest and strongest; in Malacopterygians with a dorsal spine the upper pectoral ray is frequently developed into a similar defensive weapon.

The ventral fins are the homologues of the hindlimbs, and are inserted on the abdominal surface, either behind the pectorals (*Pisces* or *Pinnæ abdominales*) or below them (*Pisces* or *Pinnæ thoracicae*), or in advance of them (*Pisces* or *Pinnæ jugulares*). They are generally narrow, and composed of a small number of rays, the outer of which is frequently osseous.

For the definition of the smaller systematic groups, and the determination of species, the numbers of the spines and rays are generally of the greatest importance. This holds good especially for the ventral rays, by the number of which the Acanthopterygian affinities of a fish can nearly always be determined. The numbers of the dorsal and anal rays generally correspond to the number of vertebrae in a certain portion of the spinous column, and are therefore constant specific, generic, or even family characters; but when their number is very great, a proportionally wide margin must be allowed for variation, and the taxonomic value of this character becomes uncertain. The numbers of the pectoral and caudal rays are rarely of any account.

The fins are organs of motion, but it is chiefly the tail and the caudal fin by which the fish impels itself forward. To execute energetic locomotion, the tail and caudal fin are strongly bent with rapidity, alternately toward the right and left; while a gentle motion forward is effected by a simple undulating action of the caudal fin, the lobes of which act like the blades of a screw. Retrograde motions can be made by fishes in an imperfect manner only, by forward strokes of the pectoral fins. When the fish wants to turn toward the left, he gives a stroke of the tail toward the right, the right pectoral acting simultaneously, while the left remains pressed close to the body. Thus the pectoral fins assist in the progressive motions of the fish, but rather by di-

recting its course than by acting as powerful propellers. The chief function of the paired fins is to maintain the balance of the fish in the water, which is always most unsteady where there is no weight to sink it; when the pectoral of one side, or the pectoral and ventral of the same side, are removed, the fish loses its balance and falls on the side opposite; when both pectorals are removed, the fish's head sinks; on removal of the dorsal and anal fins the motion of the fish assumes a zigzag course; deprived of all fins, it floats like a dead fish, with the belly upward, the back being the heavier part of the body.

In numerous groups of fishes which live in mud, or are able to pass a longer or shorter time in soil periodically dried and hardened during the hot season, forms occur entirely devoid of, or with only rudimentary, ventral fins (*Cyprinodon*, *Ophiocephalidae*, *Galaxiidae*, *Siluridae*). The chief function of these fins being to balance the body of the fish while swimming, it is evident that in fishes moving during a great part of their life over swampy ground, or through more or less consistent mud, this function of the ventral fins ceases, and nature can readily dispense with these organs altogether.

In certain fishes the shape and function of the fins are considerably modified: thus, in the rays, locomotion is almost entirely effected and regulated by the broad and expanded pectoral fins acting with an undulatory motion of their margins, similar to the undulations of the long vertical fins of the flat-fishes; in many blennies the ventral fins are adapted for walking on the sea-bottom; in some Gobioids (*Periophthalmus*), Trigloids, Scorpaenoids and *Pediculati* the pectoral fins are perfect organs of walking; in the gobies, *Cyclopteri* and *Discoboli* the ventral fins are transformed into an adhesive disk; and, finally, in the flying-fish the pectorals act as a parachute. In the eels and other snake-like fishes, the swimming as well as the gliding motions are effected by several curvatures of the body alternately toward the right and left, resembling the locomotion of snakes. In the *Syngnathi* (pipe-fishes) and *Hippocampi* (sea-horses), whose body admits of but a slight degree of lateral curvature, and whose caudal fin is generally small, if present at all, locomotion is very limited, and almost wholly dependent on the action of the dorsal fin, which consists of a rapid undulating movement.

The Skin and Scales.—The skin of fishes is either covered with scales or naked, or provided with more or less numerous scutes of various forms and sizes. Some parts, like the head and fins, are more frequently naked than scaly. All fishes provided with electric organs, the majority of eels and the lampreys, are naked. Scales of fishes are very different from those of reptiles—the latter being merely folds of the cutis, while the former are distinct horny elements, developed in grooves or pockets of the skin, like hairs, nails, or feathers.

Very small or rudimentary scales are extremely thin, homogeneous in structure, and more or less imbedded in the skin, and do not cover each other. When more developed, they are imbricated (arranged in the manner of tiles), with the posterior part extruded and free, the surface of the anterior portion being usually covered by the skin to a greater or less extent. On their surface may be observed a very fine striation concentric with, and parallel to, the margin, and coarser striæ radiating from a central point toward the hind margin. Scales, without a covering of enamel, with an entire (not denticulated) posterior margin, and with a concentric striation, are called cycloid scales. Ctenoid scales are generally thicker, and provided with spinous teeth on the posterior edges of the layers of which the scale consists. In some species, only the layer nearest to the

margin is provided with denticulations. Scales, the free surface of which is spiny, and which have no denticulation on the margin, have been termed sparoid scales; but their distinction from ctenoid scales is by no means sharp, and there are even intermediate forms between the cycloid and ctenoid types. Both kinds of scales may occur, not only in species of the same genus of fishes, but in the same fish.

Ganoid scales are hard and bony, covered with a layer of enamel; they are generally rhombic or quadrangular, rarely rounded and imbricate, and are arranged in oblique rows, those of one row being linked together by an articulatory process. This type of scales, common in fossil Ganoid fishes, occurs among recent fishes in *Lepidosteus* and *Polypierus* only.

Finally, in sharks, the *Balistidae*, and others, true scales are absent, and are replaced by the ossified papillæ of the cutis, which give the surface the appearance of fine-grained shagreen. These generally small bodies, as well as the large osseous scutes of the rays, sturgeons, etc., have been comprised under the common name placoid scales, a term which is being deservedly abandoned.

Along the side of the body of osseous fishes runs a series of perforated scales, which is called the lateral line. The perforating duct is simple at its base, and may be simple also at its outer opening, or (a frequent case) the portion on the free surface of the scale is ramified. The lateral line runs from the head to the tail, sometimes reaching the caudal fin, sometimes stopping short of it, sometimes advancing over its rays. Some species have several lateral lines, an upper one following the dorsal, a lower the abdominal outline, while a third runs along the middle as usual. The scales of the lateral line are sometimes larger than the others, sometimes smaller; sometimes they are modified into scutes; sometimes there are no other scales besides these, the rest of the body being naked. The foramina of the lateral line are the outlets of a muciferous duct which is continued on to the head, running along the infraorbital bones, and sending off a branch into the præopercular margin and mandible. The muciferous system is abundantly provided with nerves, and has therefore been considered to be the seat of a sense peculiar to fishes, but there can not be any doubt that its function is the excretion of mucus, although probably mucus is excreted also from the entire surface of the fish.

The scales, their structure, number, and arrangement, constitute an important characteristic for the determination of fishes. In most scaly fishes they are arranged in oblique transverse series; and, as the number of scales in the lateral line generally corresponds to the number of transverse series, it is usual to count the scales in that line. To ascertain the number of longitudinal series of scales, the scales are counted in one of the transverse series, generally in that running from the commencement of the dorsal fin, or the middle of the back, to the lateral line, and from the lateral line down to the vent or ventral fin, or the middle of the abdomen.

It is certain that fishes possess the faculty of perceiving odors, and that various scents attract or repel them. A mangled carcase or fresh blood attracts sharks, as well as the voracious Serrasalmonoids of the South American rivers. There is no reason to doubt that the seat of that perception is in the olfactory sac; and it may be reasonably conjectured that its strength depends mainly on the degree of development indicated by the number and extent of the interior folds of the pituitary membrane.

The position, direction and dimensions of the eyes of fishes vary greatly. In some they have an upward aspect, and are often very close together; in others they

are lateral, and in a few they are even directed downward. In a very few this organ appears to be entirely absent. In some fishes the eyes, which are on the upper side of the head, can be elevated and depressed at the will of the fish. In the range of their vision and in their acuteness of sight, fishes are very inferior to the higher classes of vertebrates, yet at the same time it is evident that they perceive their prey, or approaching danger, from a considerable distance; and it would appear that the visual powers of a *Periophthalmus*, when hunting insects on the mud-flats of the tropical coasts, are quite equal to those of a frog.

No trace of an organ of hearing has been found in *Branchiostoma*. In the Cyclostomes the labyrinth is inclosed in externally visible cartilaginous capsules laterally attached to the skull; it consists of a single semicircular canal in the Myxinoids, while the *Petromyzontes* possess two semicircular canals with a vestibulum.

In all other fishes the labyrinth consists of a vestibule and three semicircular canals, the vestibule dilating into one or more sacs, which contain the otoliths. A tympanum, tympanic cavity, and external parts are entirely absent in the class of fishes.

Some fishes, especially vegetable feeders, or those provided with broad molar-like teeth, masticate their food; and it may be observed in carps and other Cyprinoid fish that this process of mastication frequently takes some time. But the majority of fishes swallow their food rapidly, and without mastication, and therefore we may conclude that the sense of taste cannot be keen. The tongue is often entirely absent, and, even when it exists in its most distinct state, it consists merely of ligamentous or cellular substance, and is never furnished with muscles capable of producing the movements of extension or retraction as in most of the higher vertebrates. A peculiar organ on the roof of the palate of Cyprinoids is perhaps adapted for the perception of this sense; in these fishes the palate between and below the upper pharyngeal bones is cushioned with a thick, soft, contractile substance, richly supplied with nerves from the nervus vagus and nervus glosso-pharyngeus.

Organs of Touch.—The faculty of touch is more developed than that of taste, and there are numerous fishes which possess special organs of touch. Most fishes are very sensitive to external touch, although their body may be protected by hard horny scales. They perceive impressions even on those parts which are covered by osseous scutes, in the same manner as a tortoise perceives the slightest touch of its carapace. The seat of the greatest sensitiveness, however, appears to be the snout and the labial folds surrounding the mouth. Many species possess soft and delicate appendages, called barbels, which are almost constantly in action, and clearly used as organs of touch.

Some fishes appear to be much less sensitive than others, or at least lose their sensitiveness under peculiar circumstances. It is well known that a pike whose mouth has been lacerated and torn by the hook continues to yield to the temptation of a bait immediately afterward. The Greenland shark, when feeding on the carcass of a whale, allows itself to be repeatedly stabbed in the head without abandoning its prey. A pair of congers are so dead to external impression at the time of copulation, and, as it were, so automatically engaged, that they have been taken by the hand together out of the water.

ORGANS OF NUTRITION AND DIGESTION.

Fishes are for the most part either exclusively carnivorous or herbivorous, but not a few feed on vegetable as well as animal substances, or on mud containing

alimentary matter in a living or decomposing state. Generally they are very voracious, especially the carnivorous kinds, and the rule of "eat or be eaten" applies to them with unusual force. They are almost constantly engaged in the pursuit and capture of their prey, the degree of their power in these respects depending on the dimensions of the mouth and gullet and the strength of the teeth and jaws. If the teeth are sharp and hooked, they are capable of securing the most slender and agile animals; if with teeth of this kind are combined a wide gullet and distensible stomach, the fish is able to overpower and swallow others larger than itself; if the teeth are broad, strong molars, they are able to crush the hardest alimentary substances; if they are feeble, they are only serviceable in procuring some small or inert and unresisting prey. Teeth may be wanting altogether. Whatever the prey, in the majority of cases it is swallowed whole; but some of the most voracious fishes, like some sharks and *Characinidae*, are provided with cutting teeth, which enable them to tear their prey to pieces if too large to be swallowed whole. Auxiliary organs, similar to the claws of some carnivorous mammals and birds, for the purpose of seizing and overpowering their prey before it is torn by the teeth, are not found in this class; but in a few fishes the jaws themselves are modified for that purpose. In the sword-fishes the bones of the upper jaw form a long dagger-shaped weapon, with which they not only attack large animals, but also frequently kill fishes on which they feed. The saw-fishes are armed with a similar but still more complex weapon, the saw, which is armed on each side with large teeth implanted in deep sockets, specially adapted for killing and tearing the prey before it is seized and masticated by the small teeth within the mouth. Fishes show but little choice in the selection of their food, and some devour their own offspring indiscriminately with other fishes. Their digestive powers are strong and rapid, but are affected in some degree by the temperature, which, when it sinks below a certain point, lowers the vital powers of these cold-blooded animals. On the whole, marine fishes are more voracious than those inhabiting fresh waters; and, while the latter may survive total abstinence from food for weeks or months, the marine species succumb to hunger within a few days.

The organs of nutrition, manducation and deglutition are lodged in two large cavities—an anterior (the mouth or buccal cavity), and a posterior (the abdominal cavity.) In the former the alimentary organs are associated with those fulfilling the respiratory functions, the transmission of food to the stomach and of water to the gills being performed by similar acts of deglutition. The abdominal cavity commences immediately behind the head, so, however, that an extremely short thoracic cavity for the heart is partitioned off in front. Besides the alimentary organs it contains also those of the urogenital system and the air-bladder. The abdominal cavity is generally situated in the trunk only, but in numerous fishes it extends into the tail, being continued for some distance along each side of the hæmal apophyses. In numerous fishes the abdominal cavity opens outward by one or two openings. A single porus abdominalis in front of the vent is found in *Lepidosiren* and some sturgeons; a paired one, opening on each side of the vent, in *Ceratodus*, some species of sturgeon, *Lepidosteus*, *Polypterus*, *Amia*, and all Chondropterygians. As in these fishes semen and ova are discharged by their proper ducts, the abdominal openings may serve for the expulsion of semen, and those of the ova only which, having lost their way to the abdominal aperture of the oviduct, would be retained in the abdominal cavity. In those Teleosteans which lack an oviduct a single porus genitalis opens behind the vent.

Mouth.—The mouth of fishes shows extreme variation with regard to form, size and position. Generally opening in front, it may be turned upward, or it may lie at the lower side of the snout, as in most Chondropterygians, sturgeons and some Teleosteans. In most fishes the jaws are covered by the skin, which, before passing over the jaws, is often folded, forming more or less fleshy lips. In the sharks the skin retains its external character even within the teeth, but in other fishes it changes into a mucous membrane. A tongue may exist as a more or less free and short projection, formed by the glossohyal and a soft covering, or may be entirely absent. Salivary glands and a velum palati are absent in fishes.

Teeth.—With regard to the dentition, the class of fishes offers an amount of variation such as is not found in any of the other classes of vertebrates. As the teeth form one of the most important elements in the classification of fishes, their special arrangement and form will be referred to in the account of the various families and genera. While not a few fishes are entirely edentulous, in others most of the bones of the buccal cavity, or some of them, may be toothed, as the bones of the jaws, the palatines, peterygoids, vomers, basi-sphenoid, glossohyal, branchial arches, upper and lower pharyngeals. In others teeth may be found fixed in some portion of the buccal membrane without being supported by underlying bone or cartilage; or the teeth have been developed in membrane overlying one of the dentigerous bones mentioned, without having become ankylosed to the bone. When the tooth is fixed to the bone the attachment has generally been effected by the ossification of the bone of the tooth, but in some fishes a process of the bone projects into the cavity of the tooth; in others the teeth are implanted in alveoli. In these, again, frequently a process of bone rises from the bottom, on which the tooth rests.

Many of the class, especially predatory fishes, with long, lancet-shaped teeth, have all or some of these capable of being bent toward the interior of the mouth. Such "hinged" teeth resume at once the upright position when pressure is removed from them. They are, however, depressible in one direction only, thus offering no obstacle to the ingress, while they oppose the egress of prey. Mr. C. S. Tomes has shown that the means by which this mechanism is worked are different in different fishes; for, while in the *Pediculati* and Gadoids (hake) the elasticity resides solely in the tissue of the hinge (the tooth being as resilient as ever after everything else is severed), in the pike the hinge is not in the least endowed with elasticity, but the bundles of fibers proceeding from the interior of the dentine cap are exceedingly elastic.

The teeth may be, and generally are, very different as regards size or form in the different parts of the mouth; they may be also different according to the age or sex of the fish (*Raia*). The teeth may be few in number and isolated, or placed in a single, double, or triple series, distant from one another or closely set; they may form narrow or broad bands, or patches of various forms. As regards form, they may be cylindrical or conical; pointed, straight, or curved, with or without an angular bend near their base; some are compressed laterally or from the front backward (the latter may be triangular in shape, or truncated at the top like the incisors of mammals); they may have one apex (cusp) only, or be bi or tri lobate (bi or tri cuspid), or may have the margins denticulated or serrated. Compressed teeth may be confluent, and form a cutting edge in both jaws, which assume the shape of a parrot's beak. In some the apex is hooked or provided with barbs. Again, some teeth are broad, with flat or con-

vex surface, like molar teeth. With regard to size, the finest teeth are like fine flexible bristles, ciliiform or setiform; or, if very short and anchylosed to the bone, they appear only as inconspicuous asperities of the bone. Very fine conical teeth arranged in a band are termed viliform teeth; when they are coarser, or mixed with coarser teeth, they are card-like (*dents en râpe* or *en cardes*); molar-like teeth of very small size are termed granular.

In all fishes the teeth are shed and renewed during the whole course of their life.

Intestines.—The intestinal tract is divided into four portions—the œsophagus, the stomach, the small and the large intestine; two or more of these divisions may coalesce in fishes and become indistinguishable. But it is characteristic of the class that the urinary apertures are constantly situated behind the termination of the intestinal tract.

Glands.—The liver of fishes is distinguished by the great quantity of fluid fat (oil) which it contains. The gall-bladder is but rarely absent; it is attached to the right lobe, or toward the center; in some fishes, however, it is detached from the liver and connected with it by the cystic duct only. The bile may be conveyed by one or more hepatic ducts into a common duct which is continued toward the gall-bladder as ductus cysticus, and toward the duodenum as ductus choledochus; or some of the hepatic ducts enter the gall-bladder directly, or the duodenum directly, without communicating with the common duct. Individual variations in this respect are of common occurrence.

The spleen, which is substantially a lymphatic gland, may be mentioned here, as it is constantly situated in the immediate vicinity of the stomach, generally near its cardiac portion. With the exception of *Branchiostoma*, it is found in all fishes, and appears as a rounded or oblong organ of dark red color.

ORGANS OF RESPIRATION.

Fishes breathe the air dissolved in water by means of gills or branchiæ. The oxygen consumed by them is not that which forms the chemical constituent of the water, but that contained in the air which is dissolved in the water. Hence fishes transferred to water from which the air has been driven out by a high temperature, or in which the air absorbed by them is not replaced, are speedily suffocated. The absorption of oxygen by fishes is comparatively small; it has been calculated that a man consumes 50,000 times more than is required by a tench. Some fishes, however, evidently require a much larger supply of oxygen than others: eels and carps, and other fishes of similar low vitality, can survive removal from their element for days, the small quantity of moisture retained in their gill-cavity being sufficient to sustain life, while other fishes, especially such as have very wide gill-openings, are immediately suffocated after being taken out of the water. In some fishes noted for their muscular activity, like the *Scombridæ*, the respiratory process is so energetic as to raise the temperature of their blood far beyond that of the medium in which they live. A few fishes, especially such as are periodically compelled to live in water thickened into mud by desiccation and vitiated by decomposing substances, breathe atmospheric air, and generally have special contrivances for this purpose. These are so much habituated to breathing air that many of them, even when brought into pure water of normal condition, are obliged to rise to the surface at frequent intervals to take in a quantity of air, and, if they are kept beneath the surface by means of a gauze net, they perish from suffocation. The special contrivances consist of additional respiratory organs, lodged

in cavities either adjoining the gill-cavity or communicating with the ventral side of the œsophagus, or of the air-bladder which enters upon respiratory functions.

The water used by fishes for respiration is received by the mouth, driven to the gills by an action similar to that of swallowing, and expelled by the gill openings, of which there may be one or several on each side behind the head, or rarely one only in the median line of the ventral surface.

Air-bladder.—The air-bladder, one of the most characteristic organs of fishes, is a hollow sac, formed of several tunics, containing gas, situated in the abdominal cavity, but outside the peritoneal sac, entirely closed or communicating by a duct with the intestinal tract. Being compressible, its special functions consist in altering the specific gravity of the fish or in changing the center of gravity. In a few fishes it assumes the function of the organ of higher vertebrates of which it is the homologue—viz., of a lung. The gas contained in the air-bladder is secreted from its inner surface. In most fresh-water fishes it consists of nitrogen, with a very small quantity of oxygen and a trace of carbonic acid; in sea fishes, especially those living at some depth, oxygen predominates, as much as 87 per cent. having been found.

Fishes, in common with the other vertebrates, are provided with a complete circulation for the body, with another equally complete for the organs of respiration, and with a particular abdominal circulation, terminating at the liver by means of the vena portæ; but the peculiar characteristic consists in this, that the branchial circulation alone is provided at its base with a muscular apparatus or heart, corresponding to the right half of the heart of mammalia and birds.

The heart is situated between the branchial and abdominal cavities, between the two halves of the scapular arch—rarely farther behind, as in *Symbranchidæ*. It is enclosed in a pericardium, generally separated entirely from the abdominal cavity by a diaphragma, which is, in fact, the anterior portion of the peritoneum, strengthened by aponeurotic fibers. In some fishes, however, there is a communication between the pericardial and peritoneal sacs, viz., in Chondropterygians and *Acipenser*, while in the Myxinoids the pericardial sac is merely a continuation of the peritoneum.

Relatively to the size of the body, the heart is very small.

ORGANS OF REPRODUCTION.

All fishes are dioecious, or of distinct sex. The majority of fishes are oviparous (comparatively few viviparous), the embryos being developed either in the ovarium or in some dilated portion of the oviduct. In viviparous fishes actual copulation takes place, and the males of most of them are provided with copulatory or intromittent organs. In oviparous fishes the generative products are, during sexual excitement, discharged into the water, a very small quantity of semen being sufficient for effectual impregnation of a number of ova dispersed in a considerable quantity of water—circumstances which render artificial impregnation more practicable than in any other class of animals.

Instances of the female taking care of her progeny are extremely rare in fishes. At present only two examples are known, that of the Siluroid genus *Aspredo*, and the *Solenostoma*.

DOMESTICATION, TENACITY OF LIFE, HIBERNATION, ETC.

Only a few fishes are thoroughly domesticated—that is, bred in captivity, and capable of transportation within certain climatic limits—viz., the carp, crucian carp (European and Chinese varieties), tench, orfe or

ide, and goramy. The first two have accompanied civilized man almost to every part of the globe where he has effected a permanent settlement.

Attempts to acclimatize particularly useful species in countries in which they are not indigenous have been made from time to time, but have been permanently successful in a few instances only, the failures being due partly to the choice of a species which did not yield the profitable return expected, partly to utter disregard of the difference of climatic and other physical conditions between the original and the new homes of the fish. The first successful attempts at acclimatization were made with domestic species, viz., the carp and goldfish, which were transferred from Eastern Asia to Europe. Then, in the early part of the present century, the Javanese goramy was acclimatized in Mauritius and Guiana, but no care seems to have been taken to insure permanent advantages from the successful execution of the experiment. In these cases fully developed individuals were transported to the country in which they were to be acclimatized. The most successful attempt of recent years is the acclimatization of the trout and sea-trout, and probably also of the salmon, in Tasmania and New Zealand, and of the Californian salmon in Victoria, by means of artificially-impregnated ova. In transporting these ice was employed, in order to retard their development generally, and thus to preserve them from destruction during the passage across the tropical zone.

Artificial impregnation of fish-ova was first practiced by J. L. Jacobi, a native of Westphalia, in the years 1757-63, who employed exactly the same method which is followed now; and there is no doubt that this able observer of nature conceived and carried out his idea with the distinct object of advantageously restocking water-courses that had become unproductive, and increasing production by fecundating and preserving all ova which, in the ordinary course of propagation, would be left unfecundated or might accidentally perish. Physiology soon turned to account Jacobi's discovery, and artificial impregnation has proved to be one of the greatest helps to the student of embryology.

Fishes differ in an extraordinary degree with regard to tenacity of life. Some will bear suspension of respiration—caused by removal from water, or by exposure to cold or heat—for a long time, while others succumb at once. Nearly all marine fishes are very sensitive to changes in the temperature of the water, and will not bear transportation from one climate to another. This seems to be much less the case with some freshwater fishes of the temperate zones; the carp may survive after being frozen in a solid block of ice, and will thrive in the warmest parts of the temperate zones. On the other hand, some fresh-water fishes are so sensitive to a change in the water that they perish when transplanted from their native river into another apparently offering the same physical conditions. Some marine fishes may be transferred at once from salt into fresh water, like sticklebacks, some blennies, and *Cottus*, etc.; others survive the change when gradually effected, as many migratory fishes; while others, again, cannot bear the least alteration in the composition of the salt water (all pelegic fishes). On the whole, instances of marine fishes voluntarily entering brackish or fresh water are very numerous, while fresh-water fishes proper but rarely descend into salt water.

Abstinence from food affects different fishes in a similarly different degree. Marine fishes are less able to endure hunger than fresh-water fishes—at least in the temperate zones, no observations having been made in this respect on tropical fishes. Goldfishes, carps and eels are known to be able to subsist without food for

months, without showing a visible decrease in bulk; while the Trigloids, Sparoids and other marine fishes survive abstinence from food for a few days only. In fresh-water fishes the temperature of the water has great influence on their vital functions generally, and consequently on their appetite. Many cease to feed altogether in the course of the winter; a few, like the pike, are less inclined to feed during the heat of the summer than when the temperature is lowered.

Captivity is easily borne by most fishes, and the appliances introduced in modern aquaria have rendered it possible to keep in confinement fishes which formerly were considered to be intolerant of captivity, and even to induce them to propagate.

Wounds affect fishes generally much less than higher vertebrates. A Greenland shark continues to feed though its head is pierced by a harpoon or by the knife, so long as the nervous center is not touched; a pike will survive the loss of its tail, or a sea-perch that of a portion of it, and a carp that of half its snout. Some fishes, however, are much more sensitive, and perish even from the superficial abrasion caused by the meshes of the net during capture (*Mullus*).

The power of reproduction of lost parts in Teleosteous fishes is limited to the delicate terminations of their fin-rays and the various tegumentary filaments with which some are provided. These filaments are sometimes developed in an extraordinary degree, imitating the waving fronds of the seaweed in which the fish hides. The ends of the fin-rays and also the filaments are frequently lost, not only by accident, but also merely by wear and tear; and, as these organs are essential for the preservation of the fish, their reproduction is necessary. In *Dipnoi*, *Ceratodus*, and *Protopterus*, the terminal portion of the tail has been found to have been reproduced, but without the notochord.

Hibernation has been observed in many Cyprinoids and Murænoids of the temperate zones. They do not fall into a condition of complete torpidity, as reptiles and mammals do, but their vital functions are simply lowered, and they hide in sheltered holes, and cease to go abroad in search of their food. Between the tropics a great number of fishes are known to survive long-continued droughts by passing the dry season in a perfectly torpid state, imbedded in the hardened mud.

The principal benefit derived by man from the class of fishes consists in the abundance of wholesome and nourishing food which they yield. In the polar regions especially, whole tribes are entirely dependent on this class for subsistence; and in almost all nations fishes form a more or less essential part of food, many, in a preserved condition, being most important articles of trade. Their use in other respects is of but secondary importance. Codliver oil is prepared from the liver of some of the Gadoids of the northern hemisphere and of sharks, isinglass from the swim-bladder of sturgeons, Sciænoids, and Polynemoids, and shagreen from the skin of sharks and rays.

The flesh of some fishes is constantly or occasionally poisonous. When eaten, it causes symptoms of more or less intense irritation in the stomach and intestines, inflammation of the mucous membranes, and not rarely death. Poey enumerates no less than seventy-two different kinds from Cuba; and various species of *Sphyræna*, *Balietes*, *Ostracion*, *Caranx*, *Lachnolemus*, *Tetragonurus*, *Thynnus*, have been found to be poisonous in all seas between the tropics. All or nearly all these fishes acquire their poisonous properties from their food, which consists of poisonous *Medusæ* in all seas between the tropics. All or nearly all these fishes acquire their poisonous properties from their food, which consists of poisonous *Medusæ* and corals, or of decompos-

ing substances. Frequently the fishes are found to be eatable if the head and intestines are removed immediately after capture. In the West Indies it has been ascertained that all the fishes living and feeding on certain coral banks are poisonous. In other fishes the poisonous properties are developed at certain seasons of the year only, especially the season of propagation; as the barbel, pike, and burbot, whose roe causes violent diarrhoea when eaten during the season of spawning.

GEOGRAPHICAL DISTRIBUTION.

In an account of the geographical distribution of fishes the fresh water forms are to be kept separate from the marine. When we attempt, however, to draw a line between these two kinds of fishes, we meet with a great number of species and of facts which would seem to render that distinction very vague. There are not only species which can gradually accommodate themselves to a sojourn in either salt or fresh water, but there are also some that seem to be quite indifferent to a rapid change from the one into the other; so that individuals of one and the same species may be found some distance out at sea, while others live in rivers far beyond the influence of the tide, or even in inland fresh waters without outlet to the sea. The majority of these fishes belong to forms of brackish-water fauna; and, as they are not an insignificant portion of the fauna of almost every coast, we shall have to treat of them in a separate chapter.

Almost every large river offers instances of truly marine fishes ascending for hundreds of miles of their course, and not periodically, or from any apparent physiological necessity, but sporadically throughout the year. This is evidently the commencement of a change in a fish's habits; and, indeed, not a few of such fishes have actually taken up their permanent residence in fresh waters.

On the other hand, we find fishes belonging to fresh-water genera descending rivers and sojourning in the sea for a more or less limited period; but these instances are much less in number than those in which the reverse obtains.

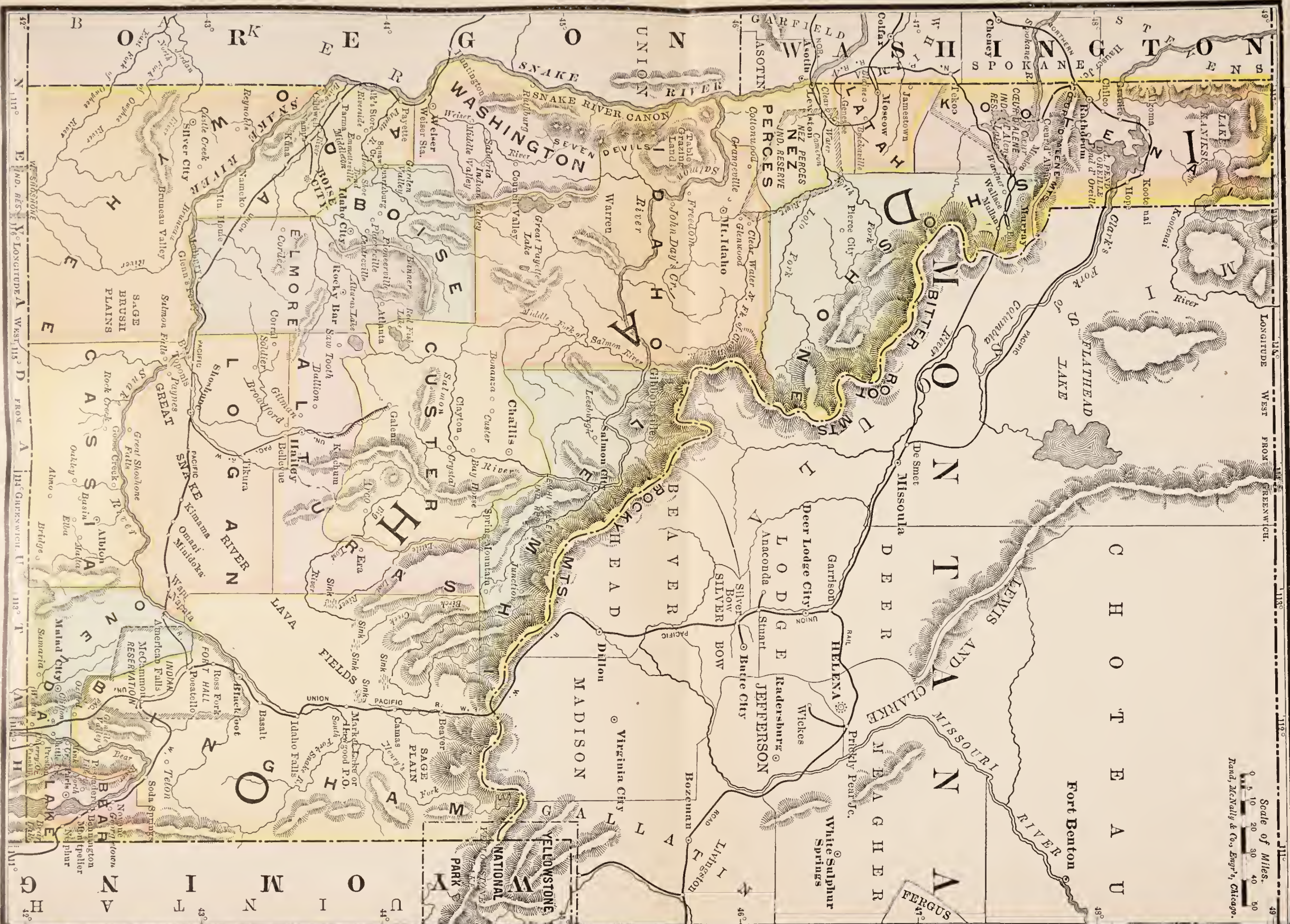
Some fishes annually or periodically ascend rivers for the purpose of spawning, passing the rest of the year in the sea, as sturgeons, many Salmonoids, some Clupeoids, lampreys, etc. The first two evidently belonged originally to the fresh-water series, and it was only in the course of their existence that they acquired the habit of descending to the sea, perhaps because their fresh-water home did not furnish a sufficient supply of food. These migrations of fresh-water fishes have been compared with the migrations of birds; but they are much more limited in extent, and do not, as is the case with birds, impart an additional element to the fauna of the place to which the fishes migrate.

The distinction between fresh-water and marine fishes is further obscured by geological changes, in consequence of which the salt water is gradually being changed into fresh, or *vice versa*. These changes are so gradual, and spread over so long a time, that many of the fishes inhabiting such localities accommodate themselves to the new conditions. One of the most remarkable and best studied instances of such an alteration is the Baltic, which, during the second half of the Glacial period, was in open and wide communication with the Arctic Ocean, and evidently had the same marine fauna as the White Sea. Since then, by the rising of the land of Northern Scandinavia and Finland, this great gulf of the Arctic Ocean has become an inland sea, with a narrow outlet into the North Sea, and, in consequence of the excess of fresh water pouring into it over the loss by evaporation, it has been so much diluted as to

be nearly fresh at its northern extremities; and yet ~~ine~~ species, the origin of which from the Arctic Ocean can be proved, have survived the changes, propagating their species, and agreeing with their brethren in the Arctic Ocean in every point, but remaining comparatively smaller. On the other hand, fishes which we must regard as true fresh-water fishes, like the rudd, roach, pike, perch, enter freely the brackish water of the Baltic. Instances of marine fishes being permanently retained in fresh water in consequence of geological changes are well known; as *Cottus quadricornis* in the large lakes of Scandinavia; species of *Gobius*, *Blennius*, and *Atherina* in the lakes of northern Italy; *Comephorus*, which seems to be a dwarfed Gadoid, in the depths of Lake Baikal. *Carcharias gangeticus* in inland lakes of the Fiji Islands, is another instance of a marine fish which has permanently established itself in fresh water.

ICHTHYOSAURUS (*ἰχθύς*, fish, *σαῦρος*, lizard), a genus of extinct reptiles, the species which are the only known representatives of the order *Ichthyopterygia*. Upward of thirty of these have been described, all of Mesozoic age, the genus so far as is certainly known appearing for the first time in the Liassic formation where it most abounds, continuing throughout the Oolitic, and disappearing before the close of the Cretaceous period. Remains of true ichthyosaurs have not yet been found on the American continent, although Professor Marsh lately (1877) described portions of the skeleton of a saurian obtained from strata of Jurassic age in the Rocky Mountains which seems to have differed from Old World ichthyosaurs chiefly in the absence of teeth, the jaws being "entirely edentulous and destitute even of a dentary groove."

Owing to the comparative abundance and excellent preservation of ichthyosaurian remains, the hard parts of those creatures have been studied under exceptionally favorable circumstances, and much has thus been learnt of their structure, and, by inference therefrom, of their life history. They were large marine reptiles, measuring in some instances thirty feet in length, and somewhat resembling in appearance the dolphins of the present day. Like these they were air-breathers, and must therefore have come to the surface to breathe, although being cold-blooded they were no doubt able, like the aquatic saurians of our own period, to remain much longer under water than the warm-blooded *Cetacea*. The ichthyosaurian head was large, and was prolonged into a more or less elongated snout, certain species rivaling in this respect the gaviel of the Ganges. The brain cavity, on the other hand, was remarkably small. The eyes were enormously large; the orbit in *Ichthyosaurus platyodon*—the largest known species—having been found to measure fourteen inches in long diameter. This huge eyeball was protected by a ring of bony sclerotic plates similar to those found in rapacious birds and in turtles and lizards of the present day. The jaws, which in *Ichthyosaurus platyodon* have been known to measure six feet in length, were rendered still more formidable by their array of strong, conical, pointed teeth, numbering in some instances over 180, and placed not in distinct sockets, as in the crocodile, but in a common alveolar groove. These, as they became worn, were replaced by a succession of young teeth, which budded up, at the base of the old. The neck in the ichthyosaurus was extremely short, and not marked by any constriction. The vertebræ resembled those of fishes in being deeply biconcave. The tail was long and tapering; in many specimens this organ has been found to be fractured at about a fourth of its length from the extremity, and, as the vertebræ of the same region seem to have been flattened vertically, Professor Owen regards it as probable that these reptiles



Scale of Miles.
0 5 10 20 30 40 50
Rand, McNally & Co., Eng'rs, Chicago.

were provided with a tegumentary caudal fin like that of the *Cetacea*, only vertical instead of horizontal; the sole evidence of the presence of such a horizontal fin in extinct whales would be the horizontally flattened condition of the last caudal vertebræ, should any of these chance to be preserved. Ichthyosaurians were provided with two pairs of limbs in the form of paddles, which externally must have borne considerable resemblance to the anterior limbs of dolphins and other *Cetacea*. They differed, however, very markedly from these in the possession of a bony apparatus, stretching, in the case of the front pair, from one shoulder joint to the other, on which the anterior paddles were supported. The hind limbs were in almost all the species much smaller than the pair in front. The skeleton of each of the paddles consisted mainly of a large number—in some species exceeding 100—of small polygonal bones arranged in more than five closely packed longitudinal rows, the whole covered with skin, and forming a highly elastic organ of locomotion. The ichthyosaur was provided with slender ribs along the vertebral column from the anterior part of the neck to the tail; a sternum, however, was wanting, the abdominal walls being strengthened by the development of transverse arcuated bones. As no trace of horny scales or bony scutes has ever been detected in connection with those reptilian remains, it may be assumed that these sea-saurians, as they have been called, were, like the *Cetacea* of the present day, covered with a smooth or wrinkled skin unprovided with any of those dermal appendages.

From a study of their bony structure it may be inferred that these huge aquatic reptiles inhabited the open sea, occasionally visiting the shores, where their powerful paddles enabled them to crawl on land, and where, like seals, they probably loved to bask in the sunshine. That they were predatory in their habits—the tyrants indeed of Mesozoic seas—might be inferred from our knowledge of their jaws and teeth; and this is amply confirmed by an examination of the half-digested contents of their stomachs. Their food seems to have consisted chiefly of ganoid fishes and the smaller reptiles, and as the vertebræ and other remains of young ichthyosaurs have occasionally been found mixed with these, there is reason to believe that they, like many other marine animals, did not hesitate to devour the weaker members of their own species.

ICONIUM (Greek, *ἰκόνιον*), an ancient city of Asia Minor, now, under the name of Cogni, Konieh, Koniye, Konijah, or Konia, the capital of the Turkish vilayet of Caramania, is situated 310 miles east from Smyrna, at the entrance to an extensive and elevated plain which forms the center of Asia Minor. The number of dwelling-houses is about 7,000, of which 150 are Armenian; and the population numbers in all probability between 40,000 and 50,000.

ICONOCLASTS. See IMAGE WORSHIP.

ICTERUS, a bird so called by classical authors, and supposed by Pliny to be the same as the *Galgulus*, which nearly all writers agree in considering to be what we now know as the Golden Oriole (*Oriolus galbula*). The typical species of *Icterus* is the *Oriolus icterus* of Linnæus, the *Icterus vulgaris* of Daudin and modern ornithologists, an inhabitant of Northern Brazil, Guiana, Venezuela, occasionally it is said visiting some of the Antilles and the United States, but without much apparent proof. They are nearly all gregarious birds, many of them with loud and in most cases, where they have been observed, with melodious notes, rendering them favorites in captivity, for they readily learn to whistle simple tunes, which are admirably reproduced by their clear voice. Some have a plumage wholly black, others are richly clad, as is the well-known Bal-

timore Oriole, Golden Robin, or Hangnest of the United States, *Icterus baltimore*, whose brightly contrasted black and orange have conferred upon it the name it most commonly bears in North America, those colors being, says Catesby, the tinctures of the armorial bearings of the Calverts, Lords Baltimore, the original grantees of Maryland, but probably more correctly those of their liveries. The most divergent form of *Icteridæ* seems to be that known in the United States as the Meadow Lark, *Sturnella magna* or *S. ludoviciana*, a bird which in aspect and habits has considerable resemblance to the larks of the Old World.

IDAHO, a northwestern State of the United States, was originally a part of Oregon, from which it was separated in 1863. It lies on the Pacific slope, with the exception of a small portion in its southeastern corner, which is drained into the Great Salt Lake of Utah. It is bounded on the north by British Columbia and northeast by Montana; on the east by Wyoming; on the south by Utah and Nevada; and on the west by Oregon and Washington. The area of the State may be set down approximately at 84,800 square miles. The mean elevation is about 4,700 feet. The lowest point, which is on Snake river, at the mouth of the Clearwater, is about 1,000 feet above the sea, while the highest mountains rise nearly to 10,000 feet. The surface is very diversified; the northern portion is largely mountainous, with several fine broad valleys. In the southern portion a large area within the great bend of the Snake river is occupied by an immense plain of basalt. South of the Snake the country is an alternation of broad valleys and narrow abrupt mountain ranges.

The principal mountains are the Bitterroot and Salmon River chains, with their spurs and subordinate ranges. They attain a height of from 8,000 to nearly 10,000 feet. The Snake River plain lies south of these mountains, extending east and west nearly across the territory. This is a field of basalt, seamed and creviced, with little vegetation, and that consisting principally of *Artemisia*. The soil here is a shifting sand; and there is little surface water, as the streams sink and flow underneath.

The principal river is the Snake, the south fork of the Columbia. It is a rapid stream, with numerous falls, three of which, the American, Shoshone, and Salmon or Fishing, are very considerable. It is navigable only in its lower course. Several of the branches of the Snake, the Salmon, Clearwater, and Spokane, are large streams, but are not navigable, and are of value only for irrigation and mining purposes.

The climate, like that of other portions of the northwestern United States, is characterized by great aridity of atmosphere and slight rainfall. In the south the aridity is such that large areas are almost desert; but in the mountainous regions of the north the rainfall is much greater, and agricultural operations can be carried on to some extent without irrigation. The northern part, being principally mountainous, is covered with forests of conifers, chiefly species of pine, spruce, fir, and tamarack. In the open valleys the vegetation consists mainly of the various kinds of grasses known collectively as "bunch-grass." On the Snake River plains there is little vegetable growth except *Artemisia*, while the country south and east of the Snake is covered with this and with grasses, with a little scattered timber (*Coniferæ* and aspens) on the mountains. A rough estimate gives as the area covered by forest 40,000 square miles, by useful grasses 23,000 square miles, and by *Artemisia* 21,300 square miles.

Though the bison formerly ranged over this whole region, it is now practically extinct. The moose is still

occasionally seen, and rarely the Rocky Mountain goat (*Aploceras montanus*). The wapiti, the mountain sheep (*Ovis montana*), and various species of deer are still abundant in the mountains, while the antelope or pronghorn abounds in the plains. Grizzly, black, and cinnamon bears, the American panther, the wild cat and the wolverine are not infrequently met with in the less-settled regions and among the forests. Of the smaller quadrupeds the prairie dog and the gopher abound in the valleys and on the plains. Birds of many species are plentiful, especially in the mountain regions. Of reptiles, several species of rattlesnakes, lizards, and horned toads are characteristic of the arid plains, where they are unpleasantly numerous.

The southern portion of Idaho has been the scene of comparatively recent volcanic action, which has covered enormous areas with basalt. The mountains of this division are mainly of the Silurian and Carboniferous ages. The ranges of the northern portion are known to be mainly Eozoic, but much remains to be done in the investigation of the geology of this section.

Idaho is represented in the Congress of the United States by two Senators and one Representative. Provision was made in the organic law for the election of a Governor and other State officers, and a representative body of two houses, similar, in most respects, to the system prevailing in the older States. An attempt to extend the suffrage to women was made, but failed to be adopted. It was provided, however, that women resident six months in the State might hold school offices and vote at school elections. Taxes for State purposes can never exceed one cent on the dollar; when the assessed valuation reaches \$50,000,000 the tax may not exceed five mills, and when it reaches \$100,000,000 the tax must be reduced to three mills on the dollar. There is a provision for a Board of Immigration, Statistics, and Labor, and eight hours is declared to be a lawful day's work, while the employment of children under fourteen years of age in underground mines is prohibited.

The principal settlements are Malade, Boisé (the capital of the State), Idaho, Buenavista, and Silver City. The population of the State at the U. S. census of 1890 was 84,385.

The valuation of real and personal property in 1889 was \$23,948,039. Agricultural lands cover 16,000,000 acres, forest lands 10,000,000, and grazing and mineral lands 20,000,000. About 8,500,000 acres have been surveyed. There were 888 miles of railroad and 907 miles of telegraph in 1889. The value of products marketed in that year was \$9,520,176.

Mining is the principal industry of Idaho. The chief minerals are gold, silver, lead, and copper, and their total value in 1889 is officially returned at \$17,344,600, almost double that of the preceding year. In the twenty-eight years, 1862-89 inclusive, the total mineral products were valued at \$157,720,962.

Idaho is rich in timber, the most valuable being black, white, and yellow pine, cedar, spruce, birch, and tamarack.

The people of Idaho being anxious to attain statehood, called a convention, which met at Boisé City, July 4, 1889, and framed a State constitution. They claimed to possess the necessary population and other qualifications for admission to the Union, and incorporated in their proposed organic act a special provision against polygamy, this being directed at the Mormons, who have in the last few years settled in the Territory. The action of the convention was ratified by the people, and in July, 1890, Idaho was admitted into the sisterhood of States, being the forty-fourth to join the Union.

The total number of Indians in Idaho is about 6,000, consisting of the tribes known as the Nez Percé, Bannack, Shoshone, Cœur d'Alène, Spokane, Pend' Oreille, and Kootenai. They are under the control of the government, and most are settled on reservations.

IDIOCY. See INSANITY.

IDLIE, a town of the West Riding of Yorkshire, in the parish of Calverley, is pleasantly situated on an eminence near the river Aire, on the Great Northern Railway, nine miles northwest of Leeds and three north of Bradford. Population (1890), 12,600.

IDOLATRY. The word *εἰδωλολατρεία* (*idololatria*, afterward shortened occasionally to *εἰδολατρεία*, *idolatria*), occurs in all four times in the New Testament, viz., in I Cor. x. 14, Gal. v. 20, I Pet. iv. 3, Col. iii. 5. In the last of these passages it is used, obviously in a typical sense, to describe the sin of covetousness or "mammon-worship." In the other places it is employed in its natural sense, but with the utmost generality, to indicate all the rites and practices of those special forms of Paganism with which Christianity first came into collision. It can only be understood by reference to the LXX., where *εἰδῶλον*, *eidolon* (like the word "idol" in A. V.) occasionally translates indifferently no fewer than sixteen words by which in the Old Testament the objects of what the later Jews called "strange worship" *עֲבוֹדָה זָרָה* are denoted. In the widest acceptance of the

word, idolatry in any form is absolutely forbidden in the second commandment, which runs "Thou shalt not make unto thee a graven image; [and] to no visible shape in heaven above, or in the earth beneath, or in the water under the earth, shalt thou bow down or render service." For some account of the various interesting questions connected with the many practical departures from this law which are recorded in the history of the Israelites the reader is referred to the article JEWS; those differences as to the interpretation of the prohibition which have so seriously divided Christendom are discussed under the head of IMAGE WORSHIP.

Most religions of which the history has been traced give distinct indications of a primitive period in which "idols" were unknown. In the Vedic hymns it is the appearances of nature themselves that are worshiped as symbols of unseen deity; and the present image worship of the Hindus is most probably Post-Buddhistic in its origin. The testimonies of the Greek historians as to the absence of religious images from the worship of the ancient Persians is confirmed by all the more recent direct investigations into the primitive life of that branch of the Aryan race. There is the same concurrence of testimony as regards the ancient Greeks; the powers of nature were in the first instance worshiped through natural symbols—such as serpents, trees, meteoric stones—and in some cases temples occurred which contained no visible symbol at all. Even in the Homeric poems, the allusions to images of the gods are but few; where an image is mentioned, it is evident that it was of the rudest description, and but little indebted to human art. The same remark applies to the cultus of ancient Rome. It was carried on without the use of images until the comparatively late period at which the state entered into relations with Etruria, Magna Græcia, and Sicily.

The decalogue contains a direct precept against the making of any "graven image," for religious uses at least. The "graven images" contemplated in the passage last cited are images of men, quadrupeds, birds, reptiles, and fishes; and the manner in which the prohibition is made is fitted to suggest that all these "likenesses" had made their appearance and already become objects of religious veneration prior to its promulgation.

Nothing certain, however, is known as to the "strange gods" alluded to in Gen. xxxv. 4 as having been buried by Jacob under the oak at Shechem; nor can much be said with regard to the "teraphim" which are first mentioned as having been worshiped in one of the branches of the family of Terah, but are often subsequently referred to as having been used in the time of the judges, and at various stages throughout the history both of the northern and of the southern kingdom. Sometimes they must have been but small; but from other passages it may be inferred that they may have been, occasionally at least, of human form and size. Much obscurity attaches also to the calf worship of which an instance occurred in the wilderness, and which was a prominent feature in the religion of the northern kingdom from the days of Jeroboam to the end; it is a disputed question whether the cult was of Egyptian or of purely Semitic origin; if so, these passages contain no allusion to image worship. The various forms of the Baal cultus so often referred to in the Old Testament were no doubt Semitic; there are no explicit references to any images, however, in this connection; and in point of fact (see BAAL) that deity was generally represented in his "high-places," not by images, but by obelisks or pillars. That the plastic arts, even in a religious connection, were not wholly discouraged among the Jews, appears from what we read, not only about the brazen serpent in the wilderness, but also about the existence in tabernacle and temple of such figures as cherubs executed in various materials, lions, oxen, lotus flowers, and pomegranates. The graphic descriptions of the process of idol-making, both "graven images" and "molten images" in Isa. xl. and xlv. show that the exercise of those arts was far from being confined, at the periods to which these passages relate, within the limits fixed by the second commandment. After the captivity, however, there developed itself among the Jews a steadily growing tendency to interpret the language of the law with the most stringent literalism; and at the time of the Roman occupation the masses, under Pharisaic influences, showed a sensitiveness on the subject of images which in certain recorded instances led to very striking results. Thus, the existence of trophies in the theater at Jerusalem was violently objected to; Vitellius found it necessary to avoid Judæa in his march from Antioch to Petra, lest the Holy Land should be defiled by the presence of the Roman eagles; at the outbreak of the Jewish war the house of Antipas at Tiberias was destroyed because it was adorned with sculptures. This aversion to every exercise of the imitative arts, as regards living things at least, passed over from Judaism to Mahometanism.

IDRIA, a mining town in Austria in the duchy of Carniola and circle of Loitsch, situated in a narrow Alpine valley on the river Idrizza, twenty-eight miles north-northeast of Trieste.

IDRISI. See EDRISI.

IDUMEA (*Ἰδουμαία*) is the Greek form of the Hebrew Edom (אֱדוֹם), a district south of the Holy Land.

The name Edom is restricted in the Bible to the mountain country southeast of the Dead Sea, and to the chain of Mount Hor near Petra. The word means "red," and the title was no doubt derived from the red color of the cliffs of Nubian sandstone, which form the greater part of this chain. The coast or desert of Edom was bounded by the desert of Zin (the present 'Arabah) on the west, by the desert of Paran on the southwest, and extended as far as Eziongeber and Eloth, at the head of the Gulf of Akabah. It is identified with Mount Seir, the possession of Esau. In later times, however, we find that the term Idumea receives a considerable exten-

sion, embracing all the pastoral country south of Judæa, and extending even within the borders of Philistia.

The aboriginal inhabitants of Idumea were the Horim or "cave dwellers" expelled by Esau.

IFFLAND, AUGUST WILHELM, a German actor and dramatic author, was born in Hanover on April 19, 1759. He died in 1814.

IGLAU, or JIHLAVA, one of the oldest towns of Moravia, and second only to Brünn in respect of size and population, is situated about fifty miles west-northwest of that city, and on the right bank of the Iglawa, close to the Bohemian frontier. Iglau is the capital of a circle of the same name, the seat of the judicial authorities, and the military headquarters of the district. The population amounts to about 20,200, most of whom are Germans or of German extraction.

IGLESIAS, a town of Sardinia, capital of a district in the province of Cagliari, is beautifully situated among limestone hills about three miles from the west coast, and at the terminus of a railway line from Cagliari, thirty-four miles west-northwest from that town.

IGLÓ, formerly NEUDORF, a mining town of North Hungary, in the county of Szepes or Zips, is pleasantly situated on the Hernád, and on the Kaschau-Oderberg line of railway, about five miles south of Lőcse (Leutschau).

IGNATIUS, St. See APOSTOLIC FATHERS.

IGNATIUS DE LOYOLA, St. See LOYOLA.

IGNORANTINES, as the Brethren of the Christian Schools are commonly though improperly called, are a religious fraternity founded at Rheims in 1679, and formally organized in 1683, by the priest Jean-Baptiste de La Salle, for the purpose of affording a free education, especially in religion, to the children of the poor. The name Ignorantine was given either on account of the low class of the pupils, or from a clause in the rules of the order forbidden its members to learn or teach Latin.

IGUALADA, a town of Spain, in the province of Barcelona, is situated on the left bank of the Noya, in a rich agricultural and vinebearing country, thirty-two miles northwest of Barcelona. Population, 11,900.

IGUANA (*Iguanidæ*), a family of lizards belonging to the suborder *Pachyglossæ* or "thick-tongued," and comprising fifty-six genera and 236 species. With a single undoubted exception, all the genera of this extensive family belong to the New World, being specially characteristic of the Neotropical region, where they occur as far south as Patagonia, while extending northward into the warmer parts of the Nearctic region as far as California and British Columbia. The single non-American genus—*Brachylophus*—occurs in the Fiji Islands. The iguanas are characterized by the peculiar form of their teeth, these being round at the root and blade-like, with serrated edges toward the tip, resembling in this respect the gigantic extinct reptile iguanodon. The typical forms belonging to this family are distinguished by the large dewlap or pouch situated beneath the head and neck, and by the crest, composed of slender elongated scales, which extends in gradually diminishing height from the nape of the neck to the extremity of the tail. The latter organ is very long, slender, and compressed, while its vertebræ, in common with those of certain other lizards, possess thin unossified septa traversing their centers. It is owing to the weakness thus produced in their vertebral column that, when caught by the tail, they are able to part so readily with the portion seized. The tongue is generally short and not deeply divided at its extremity, nor is its base retracted into a sheath; it is always moist and covered with a glutinous secretion. The prevailing color of the iguanas is green; and, as the majority of them are arboreal in their habits, such coloring may be gen-

erally regarded as protective. Those on the other hand which reside on the ground have much duller, although as a rule equally protective hues; thus Darwin observed on the shores of Bahia a terrestrial member of this family, which from its mottled appearance could hardly be distinguished from the surrounding surface. Iguanas, however, possess to an extent only exceeded by the chameleon the power of changing their colors, their brilliant green becoming transformed in an instant, under the influence of fear or irritation, into more somber hues and even into black. They differ greatly in size, from a few inches to several feet in length.

IGUANODON, a genus of extinct Dinosaurian reptiles the remains of which have been found in greatest abundance in the Wealden, a delta formation of the southeast of England. Although no complete skeleton of the iguanodon has been found, such bones of it as have been obtained prove it to have been one of the largest terrestrial animals known. Thus its femur in one instance measured from four to five feet in length, with a circumference of twenty-two inches at its narrowest part. These and other measurements led Doctor Mantell—the original discoverer of *Iguanodon*—and others to conclude that it probably attained a length of from fifty to sixty feet. Its front limbs appear to have been small, while the hind pair attained enormous development, and from the structure of the latter, which may be regarded as intermediate between those of existing reptiles and of birds, the iguanodon is supposed to have either habitually or occasionally walked on its hind legs like a bird. This supposition is rendered all the more probable by the discovery in the same strata of gigantic three-toed footsteps in pairs such as might have been formed by the iguanodon had it walked in this bipedal manner. The teeth of these animals formed one of their most marked characteristics—bearing a striking resemblance to the teeth of existing iguanas in their blade-like form and serrated edges, but differing from these as well as from those of all other known reptiles in internal structure. Like existing iguanas they were probably herbivorous, using their teeth for cutting and tearing their tough vegetable food; unlike these, however, they appear to have used their teeth also for the purpose of mastication. This is shown by the deeply worn condition in many cases of the crowns of their teeth, which, from being sharp and incisor-like, gradually assumed a molar-like form. As the old teeth were thus reduced by “tear and wear,” they were gradually replaced by a fresh dental crop. The front portion of the jaws was destitute of teeth, the upper part being beak-like, while the lower part was hollowed out like the same region in the parrot. Professor Owen regards this as an arrangement to facilitate the protrusion of what was probably a long prehensile tongue—an organ which the iguanodon may be supposed to have employed in stripping the foliage from the trees. There is no fossil evidence to show that it possessed either scutes, scales, or any other form of dermal armor.

IGUVIUM. See EUGUBINE TABLES and GUBBIO.

ILCHESTER, formerly IVELCHESTER, a market-town of Somersetshire, England, is situated in the valley of the river Ivel or Yeo, thirty-three miles south-southwest of Bath, and five miles north-northeast of Yeovil railway station.

ÎLE-DE-FRANCE, an old district of France forming a kind of island, bounded by the Marne, the Seine, the Oise, the Aisne, and the Ourcq. Until the end of the Carolingian dynasty it was included in the domains of the crown. It was bounded on the north by Picardy, on the west by Normandy, on the south by Orléannais and Nivernais, and on the east by Champagne. Its capital was Paris.

ILFRACOMBE, a market-town, seaport, and watering-place of Devonshire, is picturesquely situated on the Bristol Channel, and at the terminus of a branch of the London and South-Western Railway, eleven miles north-by-west of Barnstaple, and fifty miles northwest-by-west of Exeter. Population, 8,000.

ILHAVO, a town of Portugal, province of Beira and district of Alveiro, is situated on the Atlantic Ocean, eight miles southwest of Alveiro, and thirty-four northwest of Coimbra. Population (1890), 6,283.

ILI, one of the principal rivers of Central Asia, in what is now the Russian province of Semirychensk. The head-stream, called the Tekes (French form, Tekesse), rises at a height of 11,600 feet in the Ulabas mountains, which lie to the east of Lake Issyk-kul. At first it flows eastward and northeastward through a mountainous gorge which gradually widens into a valley of considerable breadth between the Tian-Shan range on the south and the Kara-Tau and the Temur-lik or Nan-Shan on the north. Meeting the Kunges from the east, the river takes a westerly direction; and under the name of Ili it continues to hold westward for about 300 miles, to the neighborhood of the military post of Ili or Ilijsk. At Ilijsk the river turns northwest, and at length, after traversing a district of desert and marsh, it falls by at least seven mouths into the Balkhash Lake, the first bifurcation of the delta taking place about 115 miles up the river.

ILIOS, or ILIUM. See TROAD and TROY.

ILKESTON, a market-town of Derbyshire, England, is situated on a hill commanding fine views of the Erewash valley, and on the Erewash branch line of the Midland Railway, eight miles west by north of Nottingham, and nine northeast of Derby. Pop., 19,500.

ILLE-ET-VILAINE, a maritime department of France, formed out of part of the old province of Brittany, is situated on the northwest coast. It is bounded on the north by the sea and the department of Manche, on the east by Mayenne, on the south by Loire-Inférieure, and on the west by Morbihan and Côtes-du-Nord. It takes its name from its two principal rivers, the Ille and the Vilaine. The chief town is Rennes, and the principal seaport St. Malo. The department has an area of 2,597 square miles. The population in 1872 was 589,532, and in 1886 it had reached 521,384.

ILLINOIS, the twenty-first State of the American Union, and eighth in order of admission after the formation of the original thirteen colonies into a federal government, came into the possession of statehood on December 3, 1818. It is the third state in point of population, and the nineteenth in point of area, having a superficial measurement of 56,655 square miles. About one-third of the population of the entire State is contained in the city of Chicago. The greater portion of the State is level plain. With the exception of Delaware and Louisiana, the surface is more uniform than that of any other State in the Union. It is intersected by numerous streams, bounded by bluffs, and skirted for some distance on either side by woods, the general character of its conformation being rather a succession of prairies than one continuous plain. The temperature is more nearly normal than that of almost any other State, owing to the absence of external modifying agencies. There are no mountain ranges to protect from the sweep of meteorological changes, nor are there within her bounds, if we except the great lake on the northeast corner, any agents to produce those changes. The climate is generally salubrious, becoming yearly less malarial as the soil is broken up and drained. Occasionally the thermometer takes a plunge below zero, but the mean annual temperature is about that normal to a district situated in its latitude. The summers are generally



Scale of Statute Miles
0 5 10 20 40
LONGITUDE WEST FROM WASHINGTON, 14°

pleasant, the atmosphere over its vast levels generally being in motion, and affording cooling breezes even in the highest flights of the mercury.

The mineral productions of the State include a great variety, the most important being coal, the building stones, lead, etc. The State claims to be the first in which a coal mine was ever opened on the continent, a mine having been worked at what is now Ottawa in 1670. The number of producing coal mines in 1890 was 936, employing 28,574 hands. Of first-class mines producing 50,000 tons or more per year, there are sixty-four. The most important coal-producing counties are: St. Clair, 915,827, tons; Sangamon, 730,391; Madison, 460,926; LaSalle, 657,296; Peoria, 434,900; Macoupin, 914,894; Vermilion, 345,464; Livingston, 357,600; Fulton, 304,558; Jackson, 311,279, and Perry, 319,552. The production of coal in the whole State amounted in 1890 to 13,638,364 tons.

Near Galena, in the northwest part of the State, are lead mines which have been worked for over half a century, and which, at one time, made Galena the most prosperous city in the State. Salt springs are found in the southeast counties. Stone, suitable for building, is found in various parts of the State. An inexhaustible field of limestone, called *Lemont* marble, is found near Chicago, and has been largely used in rebuilding that city after the great conflagration.

Agricultural Products.—The great crops of Illinois are Indian corn, wheat, and hay, and much attention is also given to the raising of live stock. The real value of domestic animals, as horses, mules and asses, cattle, sheep and hogs, in 1889, exceeded \$150,000,000.

The product and value of the principal crops in 1888 was as follows:

	Product.	Acreage.	Value.
Indian corn, bu.....	141,080,000	7,347,915	\$57,842,800
Wheat, bu.....	36,861,000	2,425,092	25,802,700
Rye, bu.....	2,296,000	191,330	1,125,040
Oats, bu.....	108,866,000	3,690,385	29,393,820
Barley, bu.....	723,000	41,337	397,650
Buckwheat, bu.....	51,000	5,220	32,130
Potatoes, bu.....	4,643,000	140,691	4,178,700
Tobacco, pounds.....	1,494,000	3,320	149,400
Hay, tons.....	2,724,879	3,406,099	28,039,005
Total.....		17,251,389	\$146,961,245

Railroads.—The State is admirably supplied with railroads, their extent reaching 14,017 miles.

Illinois has the largest railway mileage of any State in the Union. The capital stock of all the railroads in the State on December 1, 1890, was 930,784,536; the funded debt, \$997,407,936; current liabilities, \$27,505,798—a grand total of \$1,955,698,274. The total earnings from operations within the State during the year were returned at \$63,490,253; the operating expenses, \$40,059,894. The tonnage of freight carried within the year was 50,796,636 tons. The number of paying passengers carried was 24,910,820. The total number of employes was 182,680; there were 6,956 locomotives and 235,215 cars in service, in addition to 19,125 leased cars and locomotives. The total compensation paid to employes in 1890 was \$107,705,205. The Illinois railroads paid in taxes for the year the sum of \$3,021,904. Transportation by rail and canal is under the control of Commissioners appointed by the Governor.

Inland Navigation.—In addition to the railroad traffic there is much business done by steamboats at Cairo, East St. Louis, Alton, Quincy, Rock Island and other points on the Ohio and Mississippi rivers, though transportation by river has declined much of late years. The Illinois and Michigan canal is ninety-three miles long

and connects Lake Michigan, at Chicago, with the Illinois river, at the head of the navigation of that river. The affairs of the canal have been so wisely managed that the revenues collected have been sufficient not only to keep up repairs, but to complete the system of ripraps which will insure the banks from waste by washing and floods.

Manufactures.—The abundance of coal, the proximity to the Lake Superior iron and copper mines, the unlimited means of transportation, the supply of lumber, the cheapness of food, the superior water power in various parts of the State, have all tended to make Illinois a large and convenient seat of manufactures. The iron and steel establishments of the State rank with the largest in the country. On Rock Island, in the Mississippi river, the United States Government has an arsenal for the manufacture of ordnance. The establishment is the most extensive in the United States, and the buildings and workshops cover nearly the entire island.

The territory embraced in the present State was originally part of the French possessions, and was ceded to Great Britain in 1765, and became a portion of Virginia, after which time it was a portion of Northwest Territory. It was afterward a part of the Territory of Indiana, from which it was taken in 1809 and organized into a separate Territory with its present name. Nine years later it took its place in the sisterhood of States. Its progress has been phenomenally rapid and without cessation, its chief city, Chicago, being but an index of the progress of the entire State, which is swiftly on the march to the front rank in the Union. The present administration of the State is under its third constitution, the rapidly changing conditions of affairs necessitating two previous changes in its fundamental law. The government consists of the three departments common to all the States—executive, legislative and judicial. The executive consists of a governor and other State officers, who are elected every four years; the legislature, or general assembly, consists of a senate of fifty-one members, elected one from each district; the term of service of senators is four years, one half retiring every two years; the house of representatives consists of 153 members, of whom three are elected in each senatorial district every two years. In electing representatives, the voter may give his three votes for one, two or three candidates. This manner of voting is peculiar to the constitution of Illinois, and is called cumulative voting; it has become quite popular. The judiciary consists of a supreme court presided over by seven judges, several district appellate courts, circuit courts, and one county court (which has probate jurisdiction) in each county. Each county and each township has its own local government. Every adult male resident one year in the State may vote, unless he be a felon unpardoned. The sessions of the legislature are held at Springfield, which, since 1836, has been the capital of the State.

Finances.—The State auditor's report for the two years ending September 30, 1890, furnishes the following figures: Amount in hand October 1, 1888, \$3,839,217; receipts October, 1888, to September 30, 1890, \$10,421,335; disbursements, same period, \$9,815,084; amount in treasury September 30, 1890, \$4,445,467. The estimated expenses of the State government from October 1, 1890, to July 1, 1891, were \$2,489,754. The assessment as returned by the State Board of Equalization for the year 1890 was as follows: Personal property, \$142,201,091; lands, \$346,119,238; town and city lots, \$238,567,333; railroads, \$72,974,396; capital stock of corporations, \$6,671,909—total, \$807,196,012. The aggregate of taxes in 1889 was \$30,820,943. The bonded debt of the State outstanding on October 1, 1890, was \$19,500. In other words, Illinois has no State debt

worth mentioning. The aggregate rate of State tax for 1890 was thirty-six cents on the hundred dollars of equalized assessment.

Education and Charities.—The public school system is liberally supported in Illinois. The report of the superintendent shows that the number of children of school age in 1890 was 1,163,440; the number of pupils enrolled was 778,319; the average attendance was 537,310; the average duration of the schools was 153.3 days; the average number of days of attendance for each pupil was 105.7; the average monthly wages of male teachers was \$53.30; of female teachers, \$43.48. The total expenditure for public schools was \$12,000,000. Of this amount there was paid for salaries of teachers \$6,714,516.98, and the permanent productive school fund of the State, not including the university, was \$10,383,132.99. The University of Illinois, the State and Southern Normal Universities were reported as in excellent condition.

The State has four hospitals for the insane—at Jacksonville, Elgin, Anna and Kankakee; an institution for the blind, and one for the deaf and dumb, both at Jacksonville; an asylum for imbecile children; an eye and ear infirmary; a home for soldiers' orphans, and a reformatory school for boys. The annual expenditure for the maintenance of these charities is about \$4,000,000. Over \$5,000,000 have been expended on grounds and buildings. There are other asylums for the insane maintained by private enterprise and local authorities. Population of State, 1880, 3,080,824; 1890 (official) 3,826,351.

ILLUMINATI, or "Enlightened," is a title which at different times has been given to, or assumed by, various sects or orders of mystics, on the ground of the superior knowledge of God and of divine things which they claimed. Among these may be mentioned that of the Spanish "Alombrados" or "Alumbrados," which arose about the year 1520, and which before its final disappearance about a century later afforded numerous victims to the Inquisition, especially at Cordova. Ignatius Loyola, while a student at Salamanca (1527), was tried by an ecclesiastical commission for alleged sympathy with its views, but was acquitted with an admonition. Under the name of Illuminés a similar sect appeared in Picardy in 1623, and afterward entered into close relations with the Guérinets or followers of Pierre Guérin; but by its antinomianism it soon provoked repressive measures, to which it finally succumbed in 1635. The history of another sect of Illuminés, which appeared in the south of France about 1722, is very obscure, but it is said to have subsisted until 1794. The title of Illuminati has often been popularly bestowed also on Rosicrucians, Martinists, and Swedenborgians; but one of the most recent as well as most important applications of this elastic word has been to denote a secret society, or semi-political semi-religious order, which made some stir in Germany, especially in the southern and Catholic portions of it, from 1776 to 1784. It was founded on May 1, 1776, by Adam Weishaupt, professor of canon law at Ingolstadt, and an ex-Jesuit.

ILLUMINATION is a term which has long been used to signify the embellishment of written or printed text or design with colors, and especially with gold, more rarely also with silver. The luster of the former metal may probably have led to the adoption of the word in this sense. The Latin verb *illuminare*, with the meaning of "to decorate," occurs as early as the eighth century; and in the first portion of the *Roman de la Rose*, composed before 1260, *enluminer* is found with a similar meaning, while Dante alludes to this kind of painting and its French designation. In Early English we find the forms *enlomyne*, *luminen*, *limnen*,

whence *limn*. Of synonymous use with these terms we find in the Middle Ages the words *miniare* and *miniatura*, from *minium*, a red pigment, in early use for decorating MSS. Miniature employed in connection with the art of illumination now, however, generally signifies a picture or portrait as distinguished from mere ornament or ornate letters.

ILLYRIA is the name applied to the country that lies to the east of the Adriatic Sea. The boundaries of the country thus known varied very much at different periods. For a short time, in the fourth and third centuries B.C., there was some slight government under monarchs whose power was acknowledged by the whole country; but in general the land was either a province of some conquering race or the abode of isolated tribes with little or no common feelings or aims.

At this early period then we may say that the Danube, as the boundary between the northern and the southern family, was the limit of the Illyrian tribes toward the north. The earlier history of the Macedonian kings is one constant struggle against the Illyrian tribes. The migrations of the Gauls at the beginning of the fourth century disturbed the country between the Danube and the Adriatic. The Scordisci and other Gallic tribes settled there, and forced the Illyrians toward the south. The necessities of defense seem to have united the Illyrians under a chief Bardylis (about 383 B.C.) and his son Clitus. Bardylis nearly succeeded in destroying the rising kingdom of Macedonia; King Amyntas was defeated, and a few years later Perdiccas was defeated and slain. But the great Philip crushed them completely, and annexed part of their country. During the next century we hear of them as pirates. Issuing from the secluded harbors of the coast, they ravaged the shores of Italy and Greece, and preyed on the commerce of the Adriatic. The Greeks applied to Rome for help. Hellenism had proved too weak to civilize the northern races; it was left to the stronger organization of Rome to absorb them. Teuta, the Illyrian queen, at first scorned the Roman demands for redress, and even murdered the ambassadors; but the two Illyrian wars (229 and 219 B.C.) ended in the submission of the Illyrians, a considerable part of their frontier being annexed by the conquerors. In 168 B.C., Gentius, the Illyrian king, provoked the third Illyrian war, the result of which was the annexation of the whole country by the Romans. Frequent rebellions occurred, but at last the natives accepted the Roman civilization. During the empire, the country was one of the best recruiting grounds for the Roman legions; and in troubled times many Illyrian soldiers fought their way up from the ranks to the imperial purple. Claudius, Aurelian, Probus, Diocletian, and Maximian were all sons of Illyrian peasants.

In the time of the republic Illyricum comprised the country between the Liburnians, a kindred race, on the north and Epirus on the south. Under the empire the importance of the country made its name spread over all the surrounding districts. In the second century after Christ, the Illucricus Limes included Noricum, Pannonia, Mœsia, Dacia, and Thrace. Constantine added Greece, Epirus, and Macedonia, taking from it Thrace and part of Mœsia, and made it one of the four divisions of the Roman empire governed by a "præfectus prætorio." When the empire was divided, Illyricum was halved. Illyris Barbara or Romana, including Noricum, Pannonia, etc., was annexed to the Western empire; while Illyris Græca, including Macedonia, Epirus, and Greece, formed part of the Eastern empire. The Via Egnatia, the great line of road which connected Rome with Constantinople and the East, led across Illyricum from Dyrrachium to Thessalonica.

In the wreck of the Roman empire Illyria suffered severely. In the fourth century the Goths ravaged it repeatedly, but these, the most civilized of the barbarian invaders of Rome, with their warlike aristocracy, passed on, and were succeeded by wilder tribes. Slavs, as also Huns and other nomadic races from the East, in succession devastated the country. An agricultural population could no longer maintain itself, and all the elements of civilization disappeared. Justinian (527-565) tried in vain to defend the country by a series of forts; his armies were defeated time after time, and at last he allowed the Huns to make settlements south of the Danube. Rome gave up the defense of civilization against the inroads of barbarism, and bribed the barbarians to be quiet. Still the Via Egnatia was defended, as the artery of communication and the highway of commerce between Constantinople and the west. The open country, however, even south of the great road, was abandoned to the Slavs and Huns. The older Illyrians partly united with these races, partly went farther south, encroaching on the Greek people, and the name of one of their tribes, Albani, is preserved in the modern name of their descendants, the Albanians.

Heraclius (610-641 A.D.) settled Slavonic peoples all along the coast of Illyria as far south as Dyrrachium. The states which were thus created were of great importance in the Dark Ages. The republic of Narenta vied for a time with that of Venice; and the commerce of Ragusa was so rich that it has given its name to all wealthy merchant vessels or "argosies." The name of Illyria had by this time disappeared from history; and the country was now divided between these powerful merchant cities and the states of Bosnia, Croatia, Servia, Rascia, and Dalmatia. In literature the name was preserved, and the scene of Shakespeare's comedy *Twelfth Night* is laid in Illyria. Politically the name was revived in the beginning of this century, when the small kingdom of Illyria to the north of the Adriatic was constituted at the peace of Vienna, 1809. In 1849 the territorial distribution of the Austrian empire was remodeled, and Illyria again disappeared.

ILORI, or ILORIN (the Alourie of the Landers' expedition), an important town of the Yoruban territory of Western Africa, situated about sixty or seventy miles south of the Niger, and about 160 miles north-north-east of Lagos. Population, 150,000.

IMAGE-WORSHIP. In the present article the word "image" will be employed to denote any artificial representation, whether pictorial or sculptural, of any person or thing, real or imaginary, which is used as a direct adjunct of religious services.

As regards the attitude toward religious images assumed by the primitive Christian church, several questions have often been treated as one which cannot too carefully be kept quite apart. There can be no doubt, for example, that the early Christians were absolutely unanimous in utterly condemning all heathen image-worship and the various customs, many of them obviously immoral, with which it was associated; it is needless to multiply citations from the fathers in proof of so undisputed a fact. A form of iconolatry specially deprecated in the New Testament was the then prevalent adoration of the images of the reigning emperors. It is also tolerably certain that, if for no other reasons besides the fewness, obscurity and poverty of the early converts to Christianity, the works of art seen in their meeting houses cannot possibly at first have been numerous. Along with these reasons would certainly coöperate toward the exclusion of visible aids to devotion, not only the church's vivid recollection of what Christ had been, and its living sense of His continued real, though unseen, presence, but also, during the first

years, its constant expectation of His second advent as imminent. In point of fact it was a common accusation brought against the Christians by their enemies that they had "no altars, no temples, no known images," that "they set up no image or form of any god," and this charge was never denied. At a comparatively early date indeed we read of various Gnostic sects calling in the fine arts to aid their worship; thus Irenæus, speaking of the followers of Marcellina, says: "They possess images, some of them painted, and others formed from different kinds of material; and they maintain that a likeness of Christ was made by Pilate at that time when Jesus lived among men. They crown these images, and set them up along with the images of the philosophers of the world; that is to say, with the images of Pythagoras and Plato and Aristotle and the rest. They have also other modes of honoring these images after the same manner of the Gentiles." It is also well known that the emperor Alexander Severus found a place for several Scripture characters and even for Christ in his *lararium*. But there is no evidence that such a use of images extended itself at that early period to orthodox Christian circles; and the presumption is all the other way. The first unmistakable indication of the actual public use of the painter's art for directly religious ends does not occur indeed until the year 306 A.D., when the synod of Elvira, Spain, decreed that "pictures ought not to be in a church, lest that which is worshiped and adored be painted on walls." The scope of this prohibition has been very differently viewed by interpreters—some thinking that all that is forbidden is any attempt at delineating the divine; others considering that the synod contemplated frescoes only and not pictures, which could be more readily hidden from profanation in times of persecution; others taking the canon in the broadest sense as directed against the exhibition in churches of pictures of sacred subjects. In any case, and particularly if the last theory be adopted, it is evident that the use of sacred pictures in public worship was not at the beginning of the fourth century a thing wholly unknown within the orthodox church in Spain; and the presumption is that in other places, about the same period, the custom was looked upon with a more tolerant eye. Indications of the existence of allied forms of sacred Christian art prior to this period are not wholly wanting. It seems possible to trace some of the older and ruder frescoes in the catacombs back to a very early century; and it is certain that Bible manuscripts were often copiously illuminated and illustrated even before the middle of the fourth century. An often-quoted passage from Tertullian shows that in his day the communion cup was wont to bear a representation of the Good Shepherd. Clement of Alexandria mentions the dove, fish, ship, lyre, anchor, as suitable devices for Christian signet rings.

During the fourth and following centuries the tendency to enlist the fine arts in the service of religion and the church may be said to have steadily advanced; not, however, so far as appears, with the formal sanction of any regular ecclesiastical authority, and certainly not without strong protests raised by more than one powerful voice. How far the Christian feeling of the fourth and fifth centuries was from being thoroughly settled in favor of the employment of the fine arts is instructively shown by such a case as that of Eusebius of Cæsarea, who, in reply to a request of Constantia, sister of Constantine, for a picture of Christ, wrote that it was unlawful to possess images pretending to represent the Savior, either in His divine or in His human nature, and added that to avoid the reproach of idolatry he had actually taken away from a lady friend the pictures of Paul

and of Christ which she had. Nilus, the disciple and defender of Chrysostom, permitted the symbol of the cross in churches and also pictorial delineations of Old and New Testament history, but deprecated other symbols, pictures of martyrs, and, most of all, the representation of Christ. In the time of Gregory the Great the Western Church at last obtained something like an authoritative declaration on the vexed question about images, but in a sense not quite the same as that of the synod of Elvira. Serenus of Marseilles, on account of what he considered to be flagrant abuses, had ordered the removal and destruction of all sacred images within his diocese; this vigorous action called forth several letters from Pope Gregory, in which he utterly disapproved of that violent course, and, for the first time clearly drawing the distinction which has ever since been authoritative for the Roman Church, pointed out that "it is one thing to worship a picture and another to learn from the language of a picture what that is which ought to be worshiped. What those who can read learn by means of writing, that do the uneducated learn by looking at a picture. * * * That, therefore, ought not to have been destroyed which had been placed in the churches, not for worship, but solely for instructing the minds of the ignorant." Here it may be mentioned with regard to the symbol of the cross, that its public use dates from the time of Constantine, though, according to many Christian archæologists, it had, prior to that date, a very important place in the so-called "*disciplina arcani*." The introduction of the crucifix was decidedly later, and originally the favorite combination was that of the figure of a lamb lying at the foot of the cross; the Trullan council in 692 by its eighty-second canon enjoined that this symbol should be discontinued, and that where Christ was shown in connection with His cross He should be represented in His human nature.

It was not until the eighth century that the religious and theological questions which seem naturally to connect themselves with image-worship were at last distinctly raised in the Eastern Church in their entirety, and argued in what from some points of view might fairly be called an exhaustive manner. The controversy began with the edict by which Leo the Isaurian, in the tenth year of his reign (726), sought to deliver the church from what he called "the idolatry of image-worship." The text of that edict is not extant, but it seems to have been directed exclusively against such "idolatrous" homage as appeared to be involved in the established custom of prostration before them. The use of the strong word "idolatrous" at once led to a keen controversy, in which it was urged by the theologians that a "relative worship" might, without idolatry, be given to the image of Christ. Among those who took this ground was the famous John of Damascus, who retorted upon the iconoclastic emperor with charges of Judaizing and even of Manichæan leanings. Leo, unconvinced, but finding that his first edict had been wholly ineffectual, four years later (730) issued a second decree, of a more sweeping character than the first, inasmuch as all the holy images were ordered to be removed, and all recalcitrant bishops summarily ejected from their posts. This proceeding called forth further arguments from the theologian of Damascus, through whose influence the iconoclasts were anathematized in such churches as were not too directly and entirely under the political influence of Constantinople. At the same time (730) Pope Gregory II. addressed to the emperor two important controversial letters in favor of images. They are preserved in the *Acta* of the second council of Nice. Apart from their direct historical importance, they are of considerable interest as

literary and theological curiosities. To the objection which had of course been urged from the decalogue, he replied that the prohibition there was directed simply against the idolatry of Canaan, and could not have been intended in a sense inconsistent with the fact that Moses had been commanded to make cherubim and the like. Christ Himself was an image, the image of God. The charge that the iconoduli prayed to stones, walls, and pictures was easily met; and the further difficulty that six œcumenical councils had met and separated, but enjoined nothing about images, it was held, told distinctly against the iconoclasts, for the same councils had equally failed to urge upon men the duty of taking their necessary food. Heedless of Gregory's remonstrances, the emperor continued, during the remaining twelve years of his life, to carry on the struggle with but little effect; the religious use of images was too intimately interwoven, not only with the church life, but also with the domestic habits of his people, to yield even to the most determined efforts of an arbitrary despotism.

In 741 Leo was succeeded by Constantine Copronymus (741-775), who fully shared the iconoclastic views of his father, and in 754 convoked a council, attended by 338 bishops, but never recognized as œcumenical, which under his influence declared all reverencers of images to be men who had lapsed into idolatry; decreed that "Christ in His glorified humanity, though not incorporeal, was yet exalted above all the limits and defects of a sensuous nature, too exalted therefore to be figured by human art in an earthly material after the analogy of any other human body;" and pronounced anathema on all who attempted to express by visible colors the form of the Logos in His incarnation, and on all who delineated dumb and lifeless pictures of the saints, which could never serve any profitable end. All images whatsoever of sacred persons or things were ordered to be ejected from Christian churches; and to set them up either in public or in private buildings was forbidden under the gravest ecclesiastical penalties. The stringency of these decrees was justified by arguments drawn from reason and Scripture, as well as by appeals to such names as those of Gregory, Chrysostom, Athanasius, Epiphanius, and Eusebius. The attempt to enforce the decisions of the council as imperial laws was in many instances marked by oppressiveness and cruelty, and the general feeling of the community, fostered diligently by a numerous class of its most energetic and pious members, the monks, continued unchanged in its aversion to iconoclasm; and, although at the end of his reign Constantine succeeded in imposing upon every citizen of Constantinople an oath never again to worship an image, there can be little doubt that in a vast number of households secret leanings to image worship had been intensified rather than weakened by repressive measures. During the early part of the brief reign (775-779) of Leo IV. Chazarus, the stringency of the law was somewhat relaxed, until it was discovered that the empress (Irene) was herself a secret iconolater, when she was brought into disgrace, and numbers of her accomplices were seized and imprisoned. On the death of Leo, Irene became regent for her infant son Constantine, and, as was to be expected, used the power which she now possessed in favor of the cause she had long had at heart. With the assistance of the monks, after an abortive attempt to hold a synod at Constantinople in 786, there met at Nice in 787 a general council (the seventh œcumenical) the proceedings of which are of considerable historical importance. It was there decided that, not only the figure of the cross, but also other holy images (Christ, the Virgin Mary, angels, and saints), whether painted or executed in mosaic or other material, might be set up in churches,

placed on holy vessels and vestments, on walls and panels, in houses and by highways. The decrees, which were signed by all present, were afterward solemnly ratified at a final session (the eighth) held in Constantinople, and thus, after a struggle of sixty-one years, the worship of images asserted in the Greek Church that ascendancy which, with only one brief interruption of a few years, it has ever since maintained.

The decisions of this Eastern council were in full harmony with the personal views and practices of the popes, who, however, were compelled to show considerable moderation in the attitude they assumed. The Latin Church also, as is shown by the writings of Agobard of Lyons, and Claudius of Turin, contained strongly iconoclastic elements, which, if full scope had been given them, might conceivably have altered very considerably the current of Western opinion. On political as well as on religious grounds, however, it was felt to be inexpedient to push matters on either side to extremes; very important, therefore, at this juncture was the step taken by the emperor Charlemagne in the publication of his *De Impio Imaginum Cultu Libri IV.*, commonly called the *Libri Carolini*, in which, condemning alike the fanaticism of iconoclasts and the superstition of iconoduli, he maintained the right of images to exist for purposes of commemoration and ornament. At the synod of Frankfort-on-the-Main, held in 794, his general position was maintained, and adoration of images was wholly condemned. Great injustice was done, however, to the fathers of the second Nicene council when they were accused of maintaining that the same worship ought to be given to images of saints as to the Holy Trinity—a doctrine which they had been at special pains to repudiate. The settlement which had been obtained in 787 did not subsist entirely undisturbed even in the Eastern Church. In 815, two years after Leo the Armenian had ascended the throne, a council convoked by him at Constantinople formally abolished the decrees of Nice, and again banished the images from the churches. The new controversy, with which the name of Theodore of the Studium is still more prominently associated than was that of John of Damascus with its previous phase, went on with vicissitudes very similar to those which had formerly occurred during the reign of Leo and his successors Michael (820–830) and Theophilus (830–842). At length, during the regency of the empress Theodora, the decrees of Nice were reaffirmed by a synod at Constantinople, and the banished images were triumphantly and finally reintroduced into the metropolitan church on the day which on the first Sunday in Lent is still celebrated throughout the Greek Church as a great festival.

Down to the close of this period the “images” spoken of in ecclesiastical controversy are almost entirely pictures or mosaics—the religious use of sculptures, and particularly of statues, being little known, and, so far as known, disapproved.

At the period of the Reformation it was unanimously felt by the reforming party that, with the invocation of saints and the practice of reverencing their relics, the adoration of images ought also as a matter of course to cease. The leaders of the movement were not all, however, perfectly agreed on the question as to whether these might not in some circumstances be retained in churches. Luther, it is well known, had no sympathy with the iconoclastic outbreaks which history mentions as having taken place with some frequency at this period: he classes images in themselves as among the “*adiaphora*,” and condemned only their cultus; so also the “*Confessio Tetrapolitana*” leaves Christians free to have them or not, if only due regard be had to what is expedient and edifying. The “*Heidelberg Catechism*,”

on the other hand, emphatically declares that images are not to be tolerated at all in churches. This position, which is that of all the reformed churches, has an obvious connection with their view as to the division of the decalogue, they following Origen on this question, while the Lutherans adhere to the Philonic arrangement.

At the council of Trent the Church of Rome finally formulated the doctrine on the subject of images which is still of authority within its communion. That doctrine is avowedly based on the decrees of the second council of Nice. It is declared that images of Christ, the Virgin Mary, and other saints are to be set up and retained, especially in churches, and that “due” honor and veneration are to be accorded them by kissing and prostration. Warnings are appended, however, against their superstitious abuse somewhat in the spirit of Gregory the Great’s letter and of the decision of the Frankfort synod.

The Greek Church continues tenaciously to adhere to the decrees of the second Nicene council, and has not yielded to any of the artistic impulses which have elsewhere made themselves so powerfully felt. The sacred pictures which abound everywhere, and are treated with extraordinary reverence and affection, are for the most part very defective esthetically. Indeed, the preference seems to be given to those executed in rude archaic style, and even now the painter of pictures intended for religious uses must bear in mind the monk’s famous criticism on Titian. Nude or incompletely draped figures are forbidden, and only half lengths are permitted. No representation of the Godhead or of the Trinity is attempted. Although it is in the records of a Constantinopolitan council that the earliest extant notice of the crucifix occurs, that symbol is not now used in the East.

IMÁM is the name given to the priest who leads the prayers of a Mahometan congregation, and is exactly equivalent to Antistes. In the Koran it is said of Abraham, “Verily, I will set thee as an imám (high priest or model) for men.” In Turkey the imám, besides his function as a minister, performs the rites of circumcision, marriage, and burial. He is distinguished only by avoiding gay colors in his dress and wearing a white turban.

IMBROS, or IMVRO, an island in the Ægean Sea, lying west of the southern end of the Thracian Chersonese, about fourteen miles from the mouth of the Dardanelles. To the northwest, at a distance of seventeen miles, lies the island of Samothraki; and about the same distance to the southeast is Lemnos. The area of Imbros is estimated at 105 square miles, and its population, which is mainly of Greek origin, is about 10,000. With its bare mountain ridges and sides it has no small similarity to Attica.

IMERITIA, a district in Transcaucasia, extends from the left bank of the Tzhenys-tzkalys to the range of hills that separate it from Georgia on the east, and is bounded on the south by Akhalzikh.

IMMACULATE CONCEPTION. The dogma of the immaculate conception of the Virgin Mary, as held by the Church of Rome, is to the effect that “the most blessed Virgin was, in view of the merits of Jesus Christ the Savior of the human race, by the singular grace and favor of Almighty God, from the first moment of her conception in the womb of her mother, preserved free from all taint of original sin.” The “pious opinion” that the mother of Christ had during her life been preserved from sin in a way in which no other human being ever had been may be traced back to a comparatively early period: indeed, without it her cultus (for some account of the growth of which see MARY) as it had developed itself long before the ninth century,

would have been impossible. The actual history of an explicit doctrine of her immaculate conception, however, so far as has hitherto been discovered, may be said to begin, in the year 1140, with the letter of remonstrance which Bernard of Clairvaux wrote to the canons of the cathedral at Lyons, who, without consulting the Roman see, had recently introduced into their church a festival in celebration of that doctrine. Bernard argued vigorously against this on the ground of its novelty, its unscripturalness, and its absurdity. In the thirteenth century all the leading theologians, such as Alexander Halensis, Albertus Magnus, Bonaventura, and Thomas Aquinas, took the view of St. Bernard, their contribution to the theology of the subject consisting in an accurate definition of the moment at which the Virgin's sanctification in the womb must be held to have taken place. During the same century the feast of the Conception became very popular, and in 1263 it was accepted by a general chapter of the Franciscans at Pisa, without reference, however, to the question of immaculacy. Of great importance to the subsequent history of the dogma was the appearance in the theological world, toward the beginning of the fourteenth century, of Duns Scotus, the "subtle doctor" of the Franciscans, who, as in so many other points, so also in this, came into conflict with the still more illustrious "Doctor Angelicus," the Dominican Aquinas. In one part of his *Commentary* on the *Sentences* of Peter of Lombardy he declares for the thinkableness and even probability of Mary's having been preserved intact from original sin; in a later passage the doctrine is categorically stated. It was upon this disputed point that the long and bitter controversy between the two great mendicant orders chiefly turned.

In 1389, the Spanish Dominican Joannes de Montersono having maintained in a disputation at Paris that the view of the Scotists was unscriptural and heretical, the university, without committing itself on the main point, condemned his violent theses, and this condemnation was concurred in by the Avignon pope, Clement VII. The members of the entire Dominican order, for their refusal to acquiesce, were for several years excluded from the privileges of the university. In the beginning of the fifteenth century the famous chancellor, John Gerson, accepted the new dogma, and applied in its favor the well-known doctrine of development. At the council of Basel (in the thirty-sixth session, held September 17, 1439) it was defined and declared that the doctrine was consistent with faith, reason, and Scripture, and therefore to be approved and embraced; the contrary doctrine was not condemned, but it was forbidden to preach or to teach it. The university of Paris now made subscription to the doctrine of the Immaculate Conception a condition for its degrees, and various other universities entered into a solemn compact to use every exertion for its spread, but the controversy was far from having been brought to a close even by the action of Pope Sixtus IV., who in 1483 published a bull threatening with excommunication anyone who should accuse of heresy either the advocates or the impugnors of the doctrine, the point having not yet been decided by the apostolical see. In its fifth session (1546) the council of Trent, after formulating its decree on the subject of original sin, sought to effect a compromise between Dominicans and Franciscans by appending a declaration that it did not intend that this doctrine should be applied to the blessed and immaculate Virgin Mary, but that the constitutions of Sixtus IV. were still to be observed. In the beginning of the seventeenth century the field of battle was transferred to Spain, where, under the predominant influence of the Franciscans and Jesuits, medals were struck, pictures painted, statues erected,

and persecutions set on foot in honor of the Virgin; and embassies were sent to Rome, both by Philip III. and by Philip IV., to obtain more explicit recognition of the popular doctrine. The popes continued for a long time, however, to maintain their attitude of reserve. Paul V. (1617) forbade all public dispute on the subject, and Gregory XV. (1622) extended the prohibition even to private discussions, except in the case of Dominicans "*inter se*." But gradually the papal sympathies became more pronounced under Jesuit influences; Clement IX. gave the feast of the Conception an octave; Clement XI., in 1708, made it a festival "*de præcepto*" for all Christendom; while Benedict XIV. endeavored to reconcile St. Bernard with the more modern tendencies of Roman Catholic theology, by insisting upon subtle distinctions between the "*conceptio activa*" and the "*conceptio passiva*" of Mary. In the pontificate of Gregory XVI. several prelates received papal permission to describe her conception as immaculate; and in 1849 Pius IX. was induced to address to his bishops from Gaeta an encyclical, inviting them to state how far the dogmatic definition of the dogma would meet their wishes and the wishes of those under their charge. A large majority declared themselves strongly in favor of the proposal, and the ultimate result was that on December 8, 1854, the pope, in presence of a numerous concourse of cardinals, patriarchs, archbishops, and bishops assembled in St. Peter's, Rome, solemnly promulgated the bull "*Ineffabilis Deus*," by which the doctrine of the Immaculate Conception finally became for the Roman communion an article of faith, the denial of which is accounted to be heresy.

The feast of the Immaculate Conception is observed in the Roman Church on December 8.

IMMERMANN, KARL LEBERRECHT, dramatist and novelist, was born April 24, 1796, at Magdeburg. He died at Düsseldorf, August 25, 1840.

IMMORTELLE, or EVERLASTING. The immortelle plant belongs to the division *Tubulifloræ* of the natural family *Compositæ*, and is scientifically known as *Gnaphalium* (*Helichrysum*) *orientale* of Linnæus. It is a native of North Africa, Crete, and the parts of Asia bordering on the Mediterranean; and it is cultivated in many parts of Europe. The finest flowers are grown on the slopes of Bandols and Ciotat, where the plant begins to flower in June.

IMOLA, the ancient *Forum Cornelii*, a town of Italy, capital of a circle in the province of Bologna, is situated in a fruitful and charming plain on the old Æmilian way, near the river Santerno (ancient *Vatrenus*), twenty-one miles southeast of Bologna and forty-six northwest of Rimini, on the railway connecting those towns. Population, 11,372.

IMPEACHMENT, an exceptional and now rare form of procedure against criminals in England, in which the House of Commons are the prosecutors and the House of Lords the judges. It differs from procedure by bill of attainder, which follows the ordinary forms of legislation in both Houses, and takes effect in an Act of Parliament. In impeachment the form of procedure is strictly judicial. When the House of Commons has accepted a motion for impeachment, the mover is ordered to proceed to the bar of the House of Lords, and there impeach the accused "in the name of the House of Commons, and of all the Commons of the United Kingdom." The charges are formulated in articles, to each of which the accused may deliver a written answer. The prosecution must confine itself to the charges contained in the articles, though further articles may be adhibited from time to time. The Commons appoint managers to conduct the prosecution, but the whole House in committee attends the trial. The

defendant may appear by counsel. The hearing takes place as in an ordinary trial, the defense being allowed to call witnesses if necessary, and the prosecution having a right of reply. At the end of the case the president "puts to each peer, beginning with the junior baron, the questions upon the first article, whether the accused be guilty of the crimes charged therein. Each peer in succession rises in his place when the question is put, and standing uncovered, and laying his right hand upon his breast, answers, 'Guilty' or 'Not guilty,' as the case may be, 'upon my honor.' Each article is proceeded with separately in the same manner." Should the accused be found guilty, judgment follows if the Commons move for it, but not otherwise. The Commons thus retain the power of pardon in their own hands, and this right they have in several cases expressly claimed by resolution. The last impeachments were those of Warren Hastings (1788-95) and Lord Melville (1805), but an unsuccessful attempt was made by Mr. Anstey to impeach Lord Palmerston in 1848. The earliest recorded instances of impeachment are those of Lord Latimer in 1376, and of Pole, earl of Suffolk, in 1386.

In the constitution of the United States the procedure of impeachment is thus brought about. The House of Representatives are the accusers, and appoint managers to conduct the prosecution at the bar of the Senate. The vote of the senate is taken by putting the question separately to each member, and a majority of two-thirds is required for a conviction. In the separate States it partakes of the same quasi-political character — neither the prosecutors nor the judges being the same as in ordinary criminal offenses. The most noted instances of impeachment in the United States are those of Associate Justice Chase in 1804, of President Andrew Johnson in 1868, and of Judge Barnard, New York, in 1872. The object of impeachment is the removal of public officers for malversation in office, which is followed sometimes by disqualification for any future appointment.

INCENSE is the perfume (fumigation) arising from certain resins and gum-resins, barks, woods, dried flowers, fruits, and seeds, when burnt, and also the substances so burnt. In its literal meaning the word "incense" is one with the word "perfume," the aroma given off with the smoke of any odoriferous substance when burnt. But, in use, while the meaning of the word "perfume" has been extended so as to include everything sweet in smell, from smoking incense to the invisible fresh fragrance of fruits and exquisite scent of flowers, that of the word "incense" in all the languages of modern Europe in which it occurs, has, by an opposite process of limitation, been gradually restricted almost exclusively to frankincense. Frankincense has always been obtainable in Europe in greater quantity than any other of the aromatics imported from the East; it has therefore gradually come to be the only incense used in the religious rites and domestic fumigations of many countries of the West, and at last to be popularly regarded as the only "true" or "genuine" (*i. e.* "franc") incense.

Probably nowhere can the actual historical progress from the primitive use of animal sacrifices to the later refinement of burning incense be more clearly traced than in the pages of the Old Testament, where no mention of the latter solemnity occurs before the period of the Mosaic legislation; but in the monuments of ancient Egypt the authentic traces of the use of incense which still exist carry us back to a much earlier date. From Meroe to Memphis the commonest subject carved or painted in the interiors of the temples is that of some contemporary Phrah or Pharaoh worshiping the presid-

ing deity with oblations of gold and silver vessels, rich vestments, gems, the firstlings of the flock and herd, cakes, fruits, flowers, wine, anointing oil, and incense. Generally he holds in one hand the censer, and with the other darts the pastils or osselets of incense into it; sometimes he offers incense in one hand and makes the libation of wine with the other. The ancient Egyptians used various substances as incense. They worshipped Ra at sunrise with resin, at mid-day with myrrh, and at sunset with an elaborate confection called *kuphi*, compounded of no fewer than sixteen ingredients, among which were honey, wine, raisins, resin, myrrh, and sweet calamus. While it was being mixed, holy writings were read to those engaged in the operation. The censer used was a hemispherical cup or bowl of bronze, supported by a long handle, fashioned at one end like an open hand, in which the bowl was, as it were, held, while the other end within which the pastils of incense were kept was shaped into a hawk's head crowned with a disk, as the symbol of Ra. In embalming their dead the Egyptians filled the cavity of the belly with every sort of spicery, except frankincense, which was regarded as specially consecrated to the worship of the gods.

Homer tells us that the Egyptians of his time were emphatically a nation of druggists. This characteristic, in which, as in many others, they remarkably resemble the Hindus, the Egyptians have maintained to the present day; and, although they have changed their religion, the use of incense among them continues to be as familiar and formal as ever.

In the authorized version of the Bible, the word "incense" translates two wholly distinct Hebrew words. In various passages in the latter portion of Isaiah, in Jeremiah, and in Chronicles, it represents the Hebrew *lebannah*, more usually rendered "frankincense;" elsewhere the original word is *ketoreth*, a derivative of the verb *kitter* or *huktir*, which verb is used, not only in Ex. xxx. 7, but also in Lev. i. 9, iii. 11, ix. 13, and many other passages, to denote the process by which "the savor of satisfaction" in any burnt offering, whether of flesh or incense, is produced.

The Jews were also in the habit of using odoriferous substances in connection with the funeral obsequies of distinguished persons.

No perfectly satisfactory traces can be found of the use of incense in the ritual of the Christian Church during the first four centuries. It obviously was not contemplated by the author of the epistle to the Hebrews; its use was foreign to the synagogue services on which, and not on those of the temple, the worship of the primitive Christians is well known to have been originally modeled; and its associations with heathen solemnities, and with the evil repute of those who were known as "thurificati," would still further militate against its employment. Various authors of the ante-Nicene period have expressed themselves as distinctly unfavorable to its religious, though not of course to its domestic, use.

The character and order of these historical notices of incense would certainly, were there nothing else to be considered, justify the conclusion which has been generally adopted, that its use was wholly unknown in the worship of the Christian Church before the fifth century. On the other hand, we know that in the first Christian services held in the catacombs under the city of Rome, incense was burnt as a sanitary fumigation at least. It is natural that little should be said of so obvious a practice until the fuller development of ritual in a later age. The slighting references to it by the Christian fathers are no more an argument against its existence in the primitive church than the similar denunciations by the Jewish prophets of burnt offerings and

sacrifices are any proof that there were no such rites as the offering of incense, and of the blood of bulis and fat of rams, in the worship of the temple at Jerusalem. There could be no real offense to Christians in the burning of incense.

The missal of the Roman Church now enjoins incensation before the introit, before the gospel, and again at the offertory, in every high mass; the use of incense also occurs when the sacrament is exhibited, at consecrations of churches and the like, in processions, in the office for the burial of the dead, and at the exhibition of relics. On high festivals the altar is censured at vespers and lauds.

In the Church of England the use of incense was gradually abandoned after the reign of Edward VI., until the ritualistic revival of the present day. Its use, however, has never been abolished by law.

For the manufacture of the incense now used in the Christian churches of Europe there is no fixed rule. The books of ritual are agreed that Ex. xxx. 34 should be taken as a guide as much as possible. It is recommended that frankincense should enter as largely as possible into its composition, and that if inferior materials be employed at all they should not be allowed to preponderate. In Rome olibanum alone is employed; in other places benzoin, storax, aloes, cascarilla bark, cinnamon, cloves, and musk are all said to be occasionally used. In the Russian Church, benzoin is chiefly employed. The Armenian liturgy, in its benediction of the incense, speaks of "this perfume prepared from myrrh and cinnamon."

The preparation of pastils of incense has probably come down in a continuous tradition from ancient Egypt, Babylonia, and Phoenicia. Cyprus was for centuries famous for their manufacture, and they were still known in the middle ages by the names of pastils or osselets of Cyprus.

Maimonides, in his *More Nevachim*, states that the use of incense in the worship of the Jews originated as a corrective of the disagreeable odors arising from the slaughter and burning of the animals offered in sacrifice. There can be no doubt that its use throughout the East is based on sanitary considerations; and in Europe even, in the time when the dead were buried in the churches, it was recognized that the burning of incense served essentially to preserve their salubrity.

INCEST, carnal connection between persons so related that marriage could not take place between them according to the Levitical rules. In England incest has not generally been treated as a crime, although, along with other offenses against morals, it was made punishable by death in 1650. Since the Restoration it has, to use Blackstone's phrase, been left to the "feeble coercion of the spiritual courts." Under the divorce law, incest is one of the aggravations of adultery which entitle a wife to divorce her husband. In the law of Scotland, it is a crime nominally punishable with death, but the penalty usually inflicted is penal servitude for life. This sentence was actually pronounced on a man in 1855. In the United States, as in England, incest is not an indictable offense at common law, but it has been made so by the legislation of some of the States.

INCHBALD, MRS. ELIZABETH, an English actress, dramatic author, and novelist, was born October 15, 1753. She died at Kensington, August 1, 1821. Mrs. Inchbald's plays amount to nineteen in all.

INCUBATION. See BIRDS and REPRODUCTION. For ARTIFICIAL INCUBATION, see POULTRY.

INDEPENDENCE, capital of Jackson county, Mo., is situated ten miles east of Kansas City, at the intersection of several railroads, and four miles from the Missouri river. It was formerly the starting-point for

emigrants crossing the plains, and is an important shipping center. It has a national and other banks, nine churches, one daily and two weekly newspapers, flouring-mill, a woolen-mill, broom factory and many fine residences. Population (1890), 7,000.

INDEPENDENCE, DECLARATION OF. The immortal document which is known by this name was drafted by Thomas Jefferson, amended slightly by his colleagues of the committee of the Continental Congress, and reported and adopted on July 4, 1776. On June 7th of that year Richard Henry Lee, of Virginia, offered in the name of his State a resolution in Congress:

"That these united colonies are, and of right ought to be, free and independent States."

This resolution was seconded by John Adams, of Massachusetts; the debate upon which began on the following day, and continued two days.

On July 2, 1776, Lee's resolution was called up, and delegates from twelve colonies (New York not voting) unanimously declared "that these united colonies are, and of right ought to be, free and independent States."

But as the declaration was not reported and adopted until July 4th, the anniversary of independence was fixed on that day. The document, which had been relegated to a committee for preparation, is as follows:

When, in the course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume, among the powers of the earth, these separate and equal station to which the laws of nature and of nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.

We hold these truths to be self-evident: that all men are created equal, that they are endowed by their Creator with certain inalienable rights; that among these are life, liberty, and the pursuit of happiness. That to secure these rights, governments are instituted among men, deriving their just powers from the consent of the governed; that whenever any form of government becomes destructive of these ends, it is the right of the people to alter or abolish it, and to institute a new government, laying its foundation on such principles, and organizing its powers in such form, as to them shall seem most likely to effect their safety and happiness. Prudence, indeed, will dictate that governments long established should not be changed for light and transient causes; and accordingly all experience hath shown that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing invariably the same object, evinces a design to reduce them under absolute despotism, it is their right, it is their duty, to throw off such government, and to provide new guards for their future security. Such has been the patient sufferance of these colonies; and such is now the necessity which constrains them to alter their former systems of government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute tyranny over these States. To prove this, let facts be submitted to a candid world.

He has refused his assent to laws the most wholesome and necessary for the public good.

He has forbidden his Governors to pass laws of immediate and pressing importance, unless suspended in their operation till his assent should be obtained; and when so suspended he has utterly neglected to attend to them. He has refused to pass other laws for the accommodation of large districts of people, unless those people would relinquish the right of representation in the Legislature—a right inestimable to them, and formidable to tyrants only.

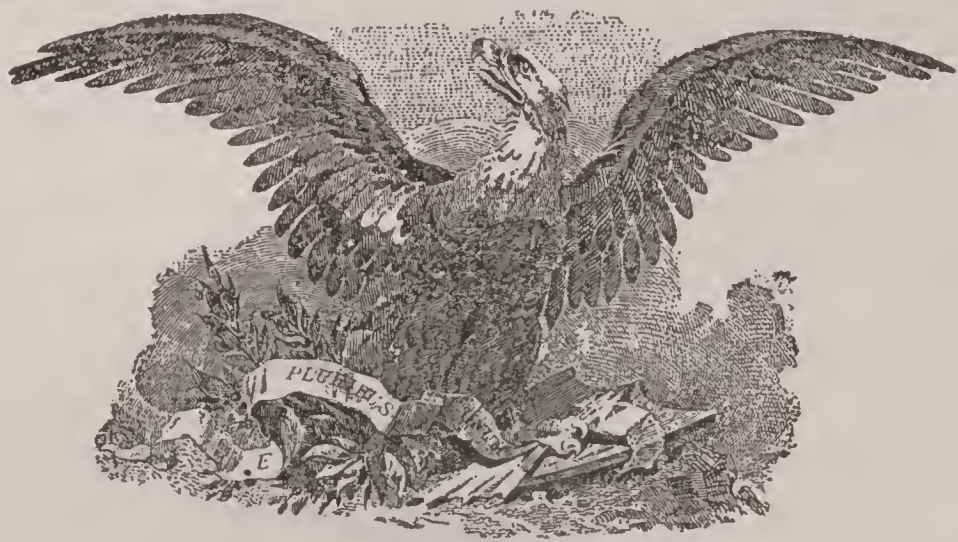
He has called together legislative bodies at places unusual, uncomfortable, and distant from the depository of their public records, for the sole purpose of fatiguing them into compliance with his measures.

He has dissolved representative houses repeatedly, for opposing, with manly firmness, his invasions on the rights of the people.

He has refused, for a long time after such dissolutions, to cause others to be elected; whereby the legislative powers, incapable of annihilation, have returned to the people at large for their exercise, the State remaining, in the meantime, exposed to all the dangers of invasion from without and convulsions within.

He has endeavored to prevent the population of these States; for that purpose obstructing the laws for naturalization of foreigners; refusing to pass others to encourage their migration hither, and raising the condition of new appropriations of lands.

Declaration of Independence



A Declaration by the Representatives of the UNITED STATES
OF AMERICA. in General Congress assembled

When in the course of human events it becomes necessary for ^{one} people to dissolve the political bands which have connected them with ^{another}, and to ~~assume among the powers of the earth the separate and equal station to which the laws of nature & of nature's god entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to ~~the~~ ^{the} separation.~~ as

We hold these truths to be ^{self-evident} ~~proved~~ ^{that} all men are created equal & independent; that ^{they are endowed by their creator with ~~unalienable~~ ^{unalienable} rights, that among ~~these~~ ^{these} are ~~life, liberty, & the pursuit of happiness~~ ^{life, liberty, & the pursuit of happiness}; that to secure these ^{rights}, governments are instituted among men, deriving their just powers from}

the consent of the governed; that whenever any form of government ~~shall~~ becomes destructive of these ends, it is the right of the people to alter or to abolish it, & to institute new government, laying ~~its~~ ^{its} foundation on

such principles & organising it's powers in such form, as to them shall
seem most likely to effect their safety & happiness. Providence indeed
will dictate that governments long established should not be changed for
light & transient causes: and accordingly all experience hath shewn that
mankind are more disposed to suffer while evils are sufferable, than to
right themselves by abolishing the forms to which they are accustomed but
when a long train of abuses & usurpations, [began at a distinguished period
&] pursuing invariably the same object, evinces a design to ~~reduce~~ reduce
them ^{under absolute Despotism} ~~to a despotic power~~, it is their right, it is their duty, to throw off such
government & to provide new guards for their future security. such has
been the patient sufferance of these colonies. & such is now the necessity
which constrains them to ^{alter} [change] their former systems of government.
the history of ^{the} ~~this~~ present ^{King of Great Britain} ~~unhappy~~ ^{speed} is a history of [unmitigated] injuries and
usurpations. [among which, ^{appears no solitary fact} ~~there is not a single instance~~ to contra-
dict the uniform tenor of the rest, ^{but all} ~~all of which~~ ^{have}] in direct object the
establishment of an absolute tyranny over these states. to prove this, let facts be
submitted to a candid world, [for the truth of which we pledge a faith
not unsullied by falsehood]

he has refused his assent to laws the most wholesome and necessary for the pub-
-lic good:

he has forbidden his governors to pass laws of immediate & pressing importance,
unless suspended in their operation till his assent should be obtained,
and when so suspended, he has ^{utterly} neglected ~~attended~~ to attend to them.

he has refused to pass other laws for the accomodation of large districts of people
unless those people would relinquish the right of representation ^{in the legislative}, a right
inestimable to them & formidable to tyrants only:

he has called together legislative bodies at places unusual, uncomfortable, & distant from
the depository of their public records, for the sole purpose of fatiguing them into compliance
with his measures;

he has dissolved Representative houses repeatedly [& continually] for opposing with
manly firmness his invasions on the rights of the people:

~~therefore~~, he has refused for a long ^{time after such dissolutions} ~~space of time~~ to cause others to be elected

Dr Franklin

Mr Adams

1st Page

Mr. Adams

whereby the legislative power, incapable of annihilation, have returned to the people at large for their exercise, the state remaining in the meantime exposed to all the dangers of invasion from without & convulsions within: he has endeavored to prevent the population of these States; for that purpose obstructing the laws for naturalization of foreigners; refusing to pass others to encourage their migrations hither, & raising the conditions of new appropriations of lands:

he has ^{obstructed} [suffered] the administration of justice [totally to cease in some of these ^{states} ~~countries~~] refusing his assent to laws for establishing judiciary powers:

he has made [our] judges dependant on his will alone, for the tenure of their offices ^{the & payment} and amount of their salaries:

Dr. Franklin

he has erected a multitude of new offices [by a self-assumed power] & sent hither swarms of officers to harass our people & eat out their substance.

he has kept among us in times of peace, ~~standing armies~~ ^{without the consent of our} standing armies [& ships of war] ^{legislatures}

he has affected to render the military independent of & superior to the civil power:

he has combined with others to subject us to a jurisdiction foreign to our constitutions and unacknowledged by our laws; giving his assent to their ^{acts of} pretended acts of legislation, for quartering large bodies of armed troops among us;

for protecting them by a mock-trial from punishment for any murders ^{which} they should commit on the inhabitants of these states;

for cutting off our trade with all parts of the world;

for imposing taxes on us without our consent;

for depriving us of the benefits of trial by jury;

for transporting us beyond seas to be tried for pretended offences:

for abolishing the free system of English laws in a neighboring province, establishing therein an arbitrary government, and enlarging its boundaries, so as to render it at once an example & fit instrument for introducing the same absolute rule into these colonies.

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Dr. Franklin

abolishing our most ^{valuable} ~~important~~ laws

for taking away our charters, & altering fundamentally the forms of our governments,

for suspending our own legislatures & declaring themselves invested with power to legislate for us in all cases whatsoever.

he has abdicated government here, [by declaring in int. of his independence & war against us. withdrawing his governors, & declaring us out of his allegiance & protection.]

John Pinn John Hancock John Hart
Wm. Hoag Wm. Pava
Geo. Read Wm. Hooper Saml Adams
Step. Hoppers Thos. Wilson Geo. Lymer
Thos. Mear Charles Carroll of Carroll Thos. Mearbridge Gerry
Roger Sherman Saml Huntington
Wm. Whipple Thomas Lynch Junr
Geo. Taylor Josiah Bartlett Benj Franklin
Wm. Williams Bkth Stockton
Oliver Wolcott Jas. Witherspoon John Morton
Thos. Stone Saml. Chas. Robt. Great Paine
George Wythe Matthew Thornton
Fran. Lewis Thos. Jefferson Henry Harrison
Lewis Morris Abra. Clark Phil. Livingston
Arthur Middleton Thos. Hopkinson
Geo. Waltone Carter Braxton
Richard Henry Lee James Wilson
Benjamin Rush John Adams Robt. Morris
Lyman Hall Joseph Hewes Button Gwinnett
Francis Lightfoot Lee
William Ellery Edward Rutledge Jas. Smith

He has obstructed the administration of justice, by refusing his assent to laws for establishing judiciary powers.

He has made judges dependent on his will alone, for the tenure of their offices, and the amount and payment of their salaries.

He has erected a multitude of new offices, and sent hither swarms of officers, to harass our people and eat out their substance.

He has kept among us, in times of peace, standing armies, without the consent of our Legislatures.

He has affected to render the military independent of and superior to the civil power.

He has combined with others to subject us to a jurisdiction foreign to our Constitution, and unacknowledged by our laws, giving his assent to their acts of pretended legislation:

For quartering large bodies of armed troops among us;

For protecting them, by a mock trial, from punishment for any murders which they should commit on the inhabitants of these States;

For cutting off our trade with all parts of the world;

For imposing taxes on us without our consent;

For depriving us, in many cases, of the benefits of trial by jury;

For transporting us beyond seas to be tried for pretended offenses;

For abolishing the free system of English laws in a neighboring province, establishing therein an arbitrary government, and enlarging its boundaries, so as to render it at once an example and fit instrument for introducing the same absolute rule into these colonies;

For taking away our charters, abolishing our most valuable laws, and altering, fundamentally, the forms of our governments;

For suspending our own Legislatures, and declaring themselves invested with power to legislate for us in all cases whatsoever.

He has abdicated government here, by declaring us out of his protection, and waging war against us.

He has plundered our seas, ravaged our coasts, burnt our towns, and destroyed the lives of our people.

He is at this time transporting large armies of foreign mercenaries to complete the works of death, desolation and tyranny, already begun with circumstances of cruelty and perfidy, scarcely paralleled in the most barbarous ages, and totally unworthy the head of a civilized nation.

He has constrained our fellow citizens, taken captive on the high seas, to bear arms against their country, to become the executioners of their friends and brethren, or to fall themselves by their hands.

He has excited domestic insurrections among us, and has endeavored to bring on the inhabitants of our frontiers the merciless Indian savages, whose known rule of warfare is an undistinguished destruction of all ages, sexes and conditions.

In every stage of these oppressions we have petitioned for redress in the most humble terms; our repeated petitions have been answered only by repeated injury. A prince whose character is thus marked by every act which may define a tyrant is unfit to be the ruler of a free people.

Nor have we been wanting in attentions to our British brethren. We have warned them, from time to time, of attempts by their legislature to extend an unwarrantable jurisdiction over us. We have reminded them of the circumstances of our emigration and settlement here. We have appealed to their native justice and magnanimity, and we have conjured them by the ties of our common kindred to disavow these usurpations which would inevitably interrupt our connections and correspondence. They, too, have been deaf to the voice of justice and consanguinity. We must, therefore, acquiesce in the necessity which denounces our separation, and hold them, as we hold the rest of mankind—enemies in war, in peace, friends.

We, therefore, the representatives of the United States of America, in general congress assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, do, in the name and by the authority of the good people of these colonies, solemnly publish and declare, that these united colonies are, and of right ought to be, free and independent states; that they are absolved from all allegiance to the British crown, and that all political connection between them and the state of Great Britain is and ought to be totally dissolved; and that, as free and independent states, they have full power to levy war, conclude peace, contract alliances, establish commerce, and do all other acts and things which independent states may of right do. And for the support of this declaration, with a firm reliance on the protection of Divine Providence, we mutually pledge to each other our lives, our fortunes, and our sacred honor.

JOHN HANCOCK,

President of Congress and Delegate from Massachusetts.

INDEPENDENTS, a religious denomination whose distinctive ecclesiastical principle is that the individual congregation or church is a society strictly voluntary and autonomous, standing directly under the authority

of Jesus Christ, living in immediate dependence on Him, and responsible to Him alone for its beliefs and acts as a Christian society. Its ideal stands distinguished, on the one hand, from Episcopacy by having no gradations of ministerial or clerical orders, or persons above the individual congregation invested with administrative or judicial authority, and, on the other hand, from Presbytery by having no gradation of courts or representative bodies possessed of legislative and judicial functions. These distinctions imply others. Episcopacy and Presbytery are essentially organized and incorporative systems, building all the societies they comprehend into a political unity, but Independency is essentially voluntary and individualizing, satisfied with a spiritual unity, refusing to permit its various societies to be built into a political organism, lest it should do violence to the rights of conscience, or prevent or even supersede the duty of the exercise by the individual of his own judgment in matters of religion.

Independency rose in the reign of Elizabeth, and may be said to have been born of the despair of seeing religion reformed and vivified on any one of the then followed lines. The peculiar condition of the Anglican Church at this period is well enough known. There were men in it who wished it to be independent of Rome, but to remain as far as possible Catholic while Anglican, and there were men who wished it to be conformed in doctrine and polity to those churches of the Continent that were by preëminence the Reformed. These latter were the Puritans, and their endeavor was to reform the church through the state, to persuade or compel the constitutive and sovereign will to make it such as they could conscientiously approve. But it was inevitable in a time of strong religious feeling that some more daring spirits should endeavor to break through the anomalies of the Puritan position. If their consciences demanded, and the civil authority refused, reform, was it either right or dutiful to submit to the civil authority as against the conscience? Was there no other way of reformation than by its consent? Was the Christian man relieved from all responsibility and obligation to obey conscience when the magistrate forbade him to do so? In so forbidding, was not the magistrate stepping out of his own province? Was the church he could so rule as to prevent the realization of the Scriptural ideal a rightly conceived and constituted church? Was it the apostolical way so to work as to plant, to purge, to organize churches only as Cæsar gave consent? And could any but the apostolical way be right?

These were the questions that created Independency. In the writings of the first Independent, Robert Browne, lies the first crude attempt at an answer. He is possessed with the idea that reformation is necessary, and is to be accomplished, not by the state, but by the action and coöperation of men who are themselves reformed and renewed. The Puritans have committed two great mistakes: they have imagined that reformation is a thing of polity only, to be carried out by changes in the organism, as it were, or structure of the church, leaving many, perhaps the immense majority, of the individuals who constitute it unreformed; and they have waited and are waiting to have the work done through and by the magistrate. Browne sets himself absolutely against both positions.

But the problems that had exercised Browne were too vital to religion to be his alone. They occupied many minds, and of these not a few looked in a similar direction for a solution. Geneva was at once the strength and the weakness of the Puritans—their strength, because it gave them their ideal realized; their weakness, because it made them think that the only method of

realization was in and through the State. The early Independents believed it possible to reform religion in England, and they acted on their belief, separating themselves from the Anglican Church, forming themselves into communities on what they regarded as the Scriptural model, and working in what was conceived to be the apostolic method. But separation from the church was a capital crime, equal to a denial of the royal supremacy; and so every inveterate separatist became liable to death. And early Independency was not without its martyrs. In the summer of 1583 two men, Thacker and Coppin, were executed at Bury St. Edmunds for refusing to conform to the church, and "dispersinge of Brownes bookes and Harrison's bookes." They justified their refusal on the ground that "her Majestie was chieffe ruler civilie, but no further." Two much more remarkable men, who met with a similar fate, were John Greenwood and Henry Barrowe.

In spite of the severely repressive measures of the government, the Independents continued to multiply. In the last decade of the sixteenth century numerous separatist communities were formed, especially in London and the eastern and northeastern counties. Their conventicles were often surprised, and in 1596 it was reckoned that as many as twenty-four had died in prison, representing, of course, but a small proportion of those actually confined. Plainly England had as yet no room for Independency, and the Independents who wished to keep a good conscience were forced to think of seeking a home elsewhere. Certain of their leaders had, indeed, in 1592 organized a church in London, with Francis Johnson as its pastor, and Greenwood as its teacher; but they were so watched and hunted and harassed—fifty-six of its members having been seized at one time and imprisoned—that they resolved, convinced by the fate of Barrowe, Greenwood, and Penry that a peaceable life in England was impossible, to emigrate in a body. Holland was then the common refuge of the distressed for conscience's sake, the place where the outcasts alike of France and Spain and England found a free and even generous home. The Independents, after trying Campden and Naarden, settled finally at Amsterdam. There they completed their church organization, appointing Francis Johnson pastor and Henry Ainsworth teacher.

A much more successful attempt at realizing the Independent ideal was made at Leyden under the leadership of John Robinson. He and his people came from Scrooby, in Nottinghamshire. Their headquarters had been at first at Gainsborough-on-Trent. In 1606 one section of the church under John Smyth—who was to become the most extreme of separatists, discovering that baptism by a corrupt church was none, to rebaptize himself and become founder of the General Baptists—emigrated to Amsterdam; the other organized themselves under Robinson at Scrooby. But peace was impossible; flight became necessary. So in 1607 and 1608 they succeeded in escaping in detachments to Holland, settling first in Amsterdam, ultimately in Leyden. There the fine qualities of Robinson found a congenial soil, and developed as they could not have done in the less generous air of England. Leyden helped to make English separatism into Independency.

The Leyden church is the parent of Independency alike in England and America. In 1616 Henry Jacob, a native of Kent, a graduate of Oxford, one of Johnson's converts, pastor awhile of a church at Middleburg, then a resident with Robinson at Leyden, returned to England, and founded an Independent church at Southwark. In 1620 a little company led by Elder Brewster and Deacon Carver sailed from Delfthaven, landed in the midst of a severe and stormy winter on the North

American coast, and there laid the foundations of the New England States, with all they were to be and to create. Jacob had been all through his exile anxiously looking toward England. In 1609 he had addressed to King James "An Humble Supplication for Toleration," in which he begs that "each particular church may be allowed to partake in the benefit of the said toleration, may have, enjoy, and put in execution and practice this her right and privilege," viz., "to elect, ordain, and deprive her own ministers, and to exercise all the other points of lawful ecclesiastical jurisdiction under Christ." This may be regarded as a clear and explicit statement of the early Independent position, its claim for toleration based on its conception of the Christian church, its plea for liberty of worship based on its principle of individualism and the rights of the individual conscience. With what was here asked it would at any time in the seventeenth century have been satisfied, but the Anglican policy of Elizabeth, and James, and Charles I. proceeded on this principle, that to allow diversity was to destroy unity, to permit the growth of elements that would prove fatal to the church, involve the denial of the royal authority and the break-up of the state. Yet the very severity of the Anglican policy strengthened Independency. It helped to identify the struggle for liberty of conscience with the struggle for English liberty.

Up to 1640 little formal progress was made. Churches did not multiply; Laud was too active, and the Star Chamber too vigorous. But the real progress was immense. Statesmen were persuaded that a system which required so harsh a policy could not be right. Religious men who could not conform went to live in lands and under laws where obedience to conscience was possible. There was a double emigration, to the Continent and to New England. In Arnheim, Thomas Goodwin and Philip Nye ministered to a small congregation; in Rotterdam, Hugh Peters and William Ames, the most skilled, scholastic, and disputatious theologian of the early Independents, who came from his professorial chair at Franeker in 1682 to die at Rotterdam a year later. Here, too, when Ames was dead and Peters gone to New England, came Jeremiah Burroughs, William Bridge, and Sidrach Simpson, all of them names that were to be conspicuous and influential in days to come.

But the emigration to New England was much the more important alike as regards its influence on Independency and English history. It has been calculated that in the period 1620–1640 upward of 22,000 Puritan emigrants (the figures have been placed as high as 50,000) sailed from English and Dutch ports. The reasons that compelled their departure determined their quality; they were all men of rigorous consciences, who loved their fatherland much, but religion more, not driven from home by mercantile necessities or ambitions, but solely by their determination to be free to worship God. They were, as Milton said, "faithful and free-born Englishmen and good Christians constrained to forsake their dearest home, their friends, and kindred, whom nothing but the wide ocean and the savage deserts of America could hide and shelter from the fury of the bishops." Men so moved so to act could hardly be commonplace; and so among them we find characters strong and marked, with equal ability to rule and to obey, as Bradford and Brewster, Winslow and Standish, Winthrop and Dr. Samuel Fuller, and men so inflexible in their love of liberty and faith in man as Roger Williams and young Harry Vane. And as were the people so were their ministers. Of these it is enough to name John Cotton, able both as a divine and as a statesman, potent in England by his expositions and apologies of

the "New England way," potent in America for his organizing and administrative power; Thomas Hooker, also famed as an exponent and apologist of the "New England way," whose book was commended to theologians at home by Thomas Goodwin, and whose early death was lamented by Cotton in lines which told how

"Zion's beauty did most clearly shine
In Hooker's rule and doctrine, both divine;"

John Eliot, famous as the "apostle to the Indians," first of Protestant missionaries to the heathen; Richard Mather, whose influence and work were carried on by his distinguished son, and his still more distinguished grandson, Cotton Mather. The motives and circumstances of the emigrants determined their polity; they went out as churches and settled as church states. They were all Puritans, but not all Independents—indeed, at first only the men from Leyden were, and they were throughout more enlightened and tolerant than the men of the other settlements. Winthrop's company were nonconformists but not separatists, esteemed it "an honor to call the Church of England, from whence we rise, our dear mother," emigrated that they might be divided from her corruptions, not from herself. But the new conditions, backed by the special influence of the Plymouth settlement, were too much for them; they became Independent—first, perhaps, of necessity, then of conviction and choice. Only so could they guard their ecclesiastical and their civil liberties. These, indeed, were at first formally as well as really identical. In 1631 the general court of the Massachusetts colony resolved "that no man shall be admitted to the freedom of this body politic, but such as are members of some of the churches within the limits of the same." Church and state, citizenship in the one and membership in the other, thus became identical, and the foundation was laid for those troubles and consequent severities that vexed and shamed the early history of Independency in New England, natural enough when all their circumstances are fairly considered, indefensible when we regard their idea of the relation of the civil power to the conscience and religion, but explicable when their church idea alone is regarded. And this latter was their own standpoint; their acts were more acts of church discipline than those of civil penalty.

Meanwhile, the growth of the New England States and their Independency in religion exercised extraordinary influence in England. It encouraged the Puritans, opened to them a refuge from the Anglican tyranny, showed them an English state where the bishop had ceased to trouble and where their own principles were active and realized. Laud thoroughly comprehended the situation, saw that Independency in the colonies must be struck down if Anglican policy was to succeed at home. They were a receptacle for schismatics, "from whence, as from the bowels of the Trojan horse, so many incendiaries might break out to inflame the nation;" and so it would be necessary to send them a bishop "for their better government, and back him with some forces to compel, if he were not otherwise able to persuade, obedience." But home politics alone were too much for Laud; and on his downfall and the outbreak of the civil war New England Independency became, on account of its influence on the ecclesiastico-political question, still more potent in English affairs. The Independent party in the Westminster Assembly—which had been called to advise Parliament—was small, but influential. Its ministerial members were Thomas Goodwin, a ponderous but learned and conscientious man; Philip Nye, a skillful debater and adroit man of business; Jeremiah Burroughs, a man of sweet manners and gentle disposition, but great prudence and

firmness; William Bridge, and Sirach Simpson. These were all marked by conspicuous moderation of view, but the lay members, like Lord Saye and Sele and Sir Harry Vane, were more advanced, especially on the cardinal question of toleration. The importance of the New England States was at once recognized by the parliamentary Independents, who made an effort to bring over their three most eminent ministers, John Cotton, John Davenport, and Thomas Hooker. The effort failed; but in place of the men books and pamphlets, expository and defensive of the "New England way," were discharged in quick succession upon the English public. What gave New England its importance was this: it was the first realization on a large scale of the principles of Independency. Here they had been tried under most difficult conditions, and had proved thoroughly successful, capable of maintaining order in the churches, religion in the state, purity of doctrine, and efficiency of discipline. What Geneva had been to the Puritans under Elizabeth New England was now to the Independents—it was their religious ideal realized, their polity commended by an illustrious example. They were no longer, as in the days of John Robinson or Henry Jacob, the apologists of an unpopular and strange theory, hitherto unrealized save on a scale and under conditions that made it ridiculous, charged with all the evils that could be proved logically certain to follow from it. On the contrary, they had now behind them the church-state beyond the ocean, and they could proudly tell how men of English blood, who had fled from the Anglican oppression, had tried Independency and prevailed. So there was the amplest controversy on the points at issue, the Scotch divines being specially active on the one side, and American divines, prefaced and introduced and explained by English, on the other. The controversy did something to lessen the distance between Presbyterians and Independents, and did much to strengthen the position of the latter in England. It showed that independence did not mean isolation, that churches that refused to be organized into a political unity still constituted a Christian brotherhood, that societies that were so jealous of their freedom and rights as to deny to every external authority judicial and legislative functions could yet seek and follow fraternal advice, and meet in common councils to advise and be advised. But the Westminster Assembly and the English Parliament did not approve the "New England way," and the Independents had to be contented to plead for toleration. This, indeed, became their great demand—the point on which they and the Presbyterians differed radically. Here the Presbyterians were inflexible. Toleration was to them the very ideal of sin. But to the Independents it was the very condition of continued existence. Without it England would be no better for them under Presbytery than it had been under Episcopacy. As to the nature and degree of toleration, they were divided into two sections, one moderate, the other more advanced. To the former belonged the ministerial members of the assembly, who wished only a limited toleration. They did not desire all views to be tolerated, but only the views of good men, men of pious, tender consciences, not those of infidels or blasphemers. But the more advanced section courageously advocated absolute toleration, denied that so long as a man was a peaceable citizen the magistrate had any right to interfere with his conscience or conscientious beliefs. To this section belonged Harry Vane, Henry Burton, John Goodwin of Coleman Street, ablest and most restless of controversialists in that controversial age; Roger Williams, now a Baptist, but still an Independent, home from America, bringing with him the MS. of a great book on this very subject; finally, above all, John

Milton. These were the advanced guard, and theirs was the section that made Independency so immense a political power in the England of the Commonwealth.

The men Independency formed and forced to the front were remarkable men, strong of will, clear of eye, mighty through faith in their principles. And their principles were precisely of the kind suited to the emergency, republican and revolutionary, but steeped in the commanding emotions and enthusiasms of religion. They were principles that ennobled man, that asserted the rights of the individual, and made it an easy matter to deal with the divine rights of kings, or kings too assertive of their rights and forgetful of their duties. So the Independents had the incalculable advantage of always seeing clearly before them, knowing their end and never being in any doubt about the way to it. Besides, their theory of the church fell in with the spirit of the Commonwealth. It made but small distinction between clergy and laity, and the man with the gift of speech could easily exercise it in preaching. So the army when new modeled, formed of men of spirit and conviction, became quite a nursery of Independents, and men like Richard Baxter found that in it there were quite as many ready to edify as wishful to be edified. Religion thus became, not a matter for the clergy, but the possession of the people, not simply the concern of the church, but the business of the whole nation. There was considerable diversity in theological opinion. The moderate men were Calvinists, but among the extreme men were Arminians, like John Goodwin, and men as yet of no recognized school, like John Milton. Independency, in short, meant the equal concern of every man in religion, alike in its deepest mysteries and most practical precepts; and so in a period of religious enthusiasm and ferment it naturally came to the front and took the lead. But the extent of its power under the Commonwealth was the measure of the disfavor that came to it after the Restoration. The Presbyterians had been mainly instrumental in the bringing back of Charles, and so it had been indecent had no attempt been made to comprehend them within the church. But in the case of the Independents there was not even an abortive attempt at comprehension. And they did not ask what they knew they would not receive. They only wished to be tolerated, to be allowed to live, and no more. At first they thought that this might be. Philip Nye had seen the king and was hopeful. But their illusions were soon dispelled. In 1661 the Corporation Act was passed, which disqualified Nonconformists for municipal offices; in 1662 the Act of Uniformity, which drove upward of 2,000 ministers out of the church, and silenced all who did not conform; in 1663 the Conventicle Act, which prevented Nonconformist congregations meeting, not allowing in houses more than five persons beyond the family to be present at once. In 1665 the Five Mile Act forbade nonconforming ministers to come within five miles of any corporate borough; in 1670 the Conventicle Act was made more rigorous; and in 1673 the Test Act made Nonconformists ineligible for offices, civil, naval, or military, under the crown. Charles, who, indeed, in his weak way, tried to be more generous than his church or parliament, wished to tolerate the Nonconformists that he might the better tolerate the Roman Catholics. Out of this feeling came the Declaration of Indulgence in 1672—which was, incidentally, the means of proving the strength of dissent, 3,000 applications being made for licenses to use or erect places of worship; but parliament resisted, and Charles gave way.

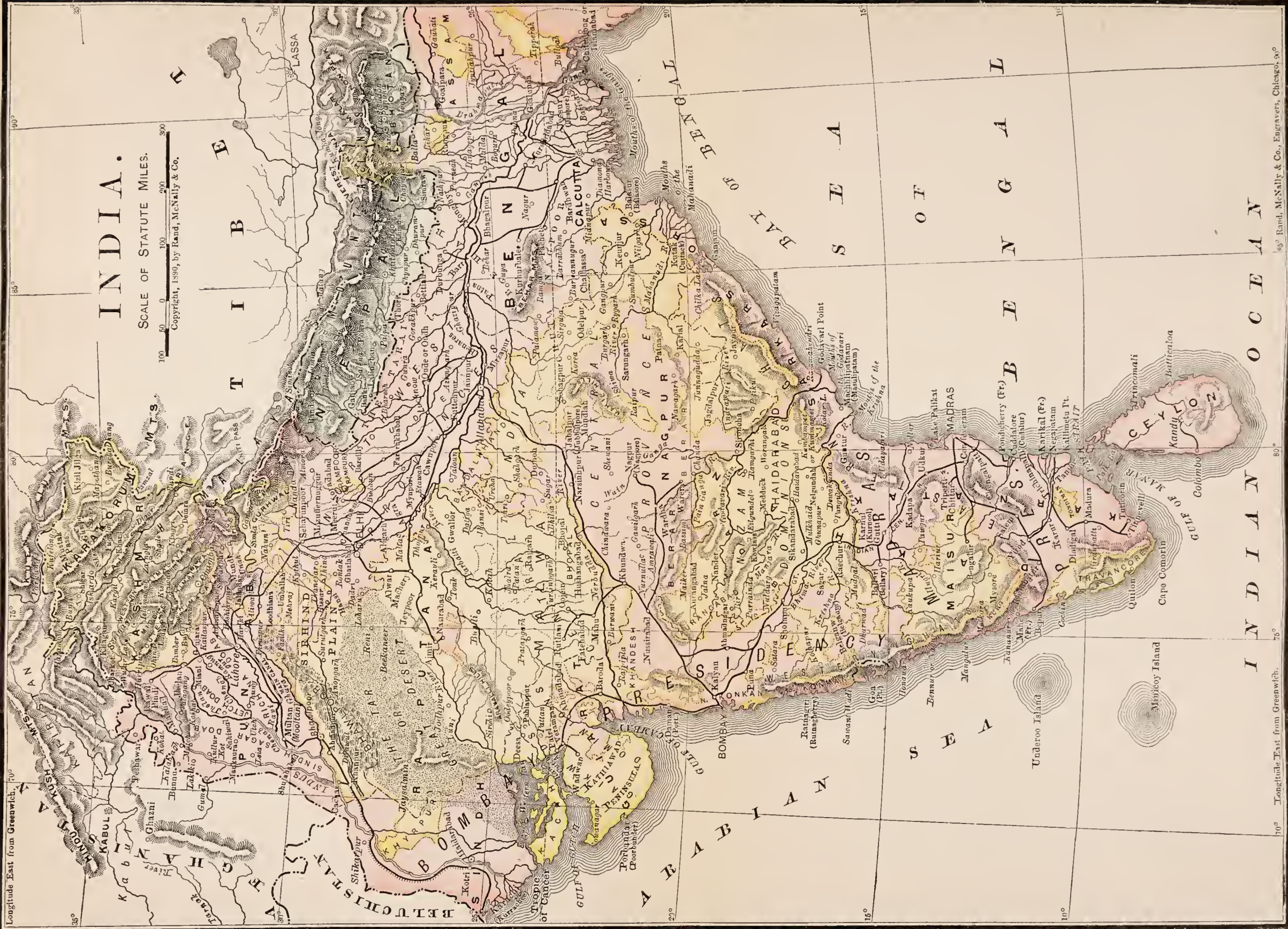
In the dark days that had now come to them, the Independents, it may be well said, lived with patient courage, and learned through their sufferings. They had

men among them that adorned their adversity, and made even their sudden obscurity illustrious. Their conduct under James showed that they would not purchase their own privileges at the expense of the public safety, and under William their fidelity to the constitution and liberties of England had its first reward in the Act of Toleration. This was but a small concession, and one that by the Occasional Conformity Act of Anne was almost as good as repealed. But what had been done could not be altogether undone. The coming in of the Hanoverian dynasty brought a more liberal spirit into politics, and history has ever since, with an occasional period of declension, been a progressive movement toward freedom. As, one by one, its principles and claims have been admitted by the state, England has become a roomier and healthier place for spirits who feel that for religion to be religious it must be free.

INDEX is a word that may be understood either specially as a table of references to a book or, more generally, as an indicator of the position of required information on any given subject. According to classical usage, the Latin word *index* denoted a discoverer, discloser, or informer; a catalogue or list; an inscription; the title of a book; and the fore or index finger. Cicero also used the word to express the table of contents to a book, and explained his meaning by the Greek form *syllabus*. Shakespeare uses the word with a general meaning of a table of contents or preface. Table was the usual English word, and index was not thoroughly naturalized until the beginning of the seventeenth century, and even then it was usual to explain it as "index or table."

INDEX LIBRORUM PROHIBITORUM is the title borne by the official list of those books which on doctrinal or moral grounds the Roman Catholic Church, under penalty of ecclesiastical censures, authoritatively forbids the members of her communion to possess or to read. Most governments, whether civil or ecclesiastical, have at all times in one way or another acted on the general principle that some control may and ought to be exercised over the literature circulated among those under their jurisdiction. The earliest known instance of a list of proscribed books being issued with the authority of a bishop of Rome is sometimes assigned to the pontificate of Gelasius (494) and sometimes to that of Hormisdas (514), but most probably ought not to be dated earlier than the eighth century. The document is for the most part, as its name implies, a *Notitia Librorum Apocryphorum qui non recipiuntur*, and chiefly consists of an enumeration of such apocryphal works as by their titles might be apt to mislead the unwary into attaching an undue weight to their teaching. Subsequent pontiffs continued to exhort the episcopate and the whole body of the faithful to be on their guard against heretical writings, whether old or new; and one of the functions of the Inquisition when it was established was to exercise a rigid censorship over books put in circulation. The bishops in their dioceses had always, however, a considerable discretion. With the discovery of the art of printing, and the wide and cheap diffusion of all sorts of books which ensued, the need for new precautions against heresy and immorality in literature made itself felt, and more than one pope gave special direction to the archbishops of Cologne, Mainz, Treves, and Magdeburg regarding the growing abuses of the printing press; in 1515 the Lateran council formulated the decree *de Impressione Librorum*, which required that no work should be printed without previous examination by the proper ecclesiastical authority, the penalty of unlicensed printing being excommunication of the culprit, and confiscation and destruction of the books. The council of Trent in its fourth session, April 8, 1546, forbade the

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sale or possession of any anonymous religious book which had not previously been seen and approved by the ordinary; in the same year the university of Louvain, at the command of Charles V., prepared an *Index* of pernicious and forbidden books, a second edition of which appeared in 1550.

In 1557, and again in 1559, Pope Paul IV., through the Inquisition at Rome, published what may be regarded as the first Roman *Index* in the modern ecclesiastical use of that term. All anonymous works published since 1519 were condemned without exception in this *Index*, which directed its hostility chiefly against works that seemed unfavorable to the claims of the Roman curia, or maintained the superiority of councils over popes. A list of sixty-two printers of heretical books was appended. At the eighteenth session of the council of Trent (February 26, 1562), in consideration of the great increase in the number of suspect and pernicious books, and also of the inefficacy of the many previous "censures" which had proceeded from the provinces and from Rome itself, certain fathers were appointed to inquire into these "censures," and to consider what ought to be done in the circumstances. At the twenty-fifth session (December 4, 1563) this committee of the council was reported to have completed its work, but as the subject did not seem (on account of the great number and variety of the books) to admit of being properly discussed by the council, the result of its labors was handed over to the pope (Pius IV.) to deal with as he should think proper. In the following March accordingly were published, with papal approval, the *Index librorum prohibitorum*, which continues to be reprinted and brought down to date, and the "Ten Rules" which, supplemented and explained by Clement VIII., Sixtus V., Alexander VII., and finally by Benedict XIV. (July 10, 1753), still regulate the preparation of that catalogue. By the first of these rules the condemnation of all books already condemned by pope or council prior to 1515 is renewed; by the second the works of "heresiarchs" (Luther, Zwingli, Calvin, Schwenkfeld, Hübmaier) are condemned whatever be their subject, but it is provided that the non-religious works of those who are heretics merely may on examination and approval be permitted; the third and fourth relate to translations of the Bible; the fifth orders the expurgation of lexicons, concordances, and similar compilations by heretics; the sixth discourages the circulation of books in the vulgar tongue about controversies between Catholics and heretics; the seventh, eighth, and ninth relate to obscene or grossly superstitious publications; the tenth contains various details of procedure about the licensing of books, and concludes with the declaration that the possessor or reader of heretical books is forthwith to be excommunicated, while the possessor or reader of books prohibited on other grounds falls into mortal sin, and is to be dealt with severely at the discretion of the bishop. The business of correcting the *Index* to date is now in the hands of an ecclesiastical board known as the "Congregation of the Index," which consists of a prefect (who is always a cardinal) and other cardinals, with whom are associated the "consulters" and "examiners of books." The *Index Librorum Expurgandorum* or *Expurgatorius* catalogues the works which may be read after the deletion of specified passages. Bishops have the power of granting at their discretion the right to read forbidden books, except in some reserved cases, where the papal dispensation is required. The Roman *Index* is unfortunately very far from being an exhaustive catalogue of works inconsistent with Catholic orthodoxy, and thus lacks the interest and vast importance it would otherwise have had for the bibliographer.

The early Reformers, by their attitude toward writings which from their point of view seemed objectionable, furnished many an *argumentum ad hominem* to the Catholics; thus we find Calvin writing to the ministers at Frankfort about one of the books of Servetus, with a view to its being burnt. Gradually, however, all the Protestant churches have recognized the expediency of leaving individuals and communities practically free to select for their instruction and amusement the works which in the conscientious exercise of their own responsible judgment they may find best adapted to their wants.

INDIA is a great empire of Asia, composed of nine provinces under direct British administration, and about 151 feudatory states and principalities, which equally with the British provinces acknowledge the paramount sovereignty of the British crown. The whole empire contains close on 1,500,000 square miles, and 260,000,000 of inhabitants. The area, therefore, is almost equal to, and the population is just about equal to, the area and population of all Europe, less Russia. The people number more than Gibbon's estimate of 120,000,000 for all the races and nations which obeyed Imperial Rome.

The natives of India can scarcely be said to have a word of their own by which to express their common country. In Sanskrit, it would be called "Bhārata-varsha," from Bharata, a legendary monarch of the Lunar line; but Sanskrit is no more the vernacular of India than Latin is of Europe. The name "Hindustán," which was at one time adopted by European geographers, is of Persian origin, meaning "the land of the Hindus," as Afghánistán means "the land of Afgháns." According to native usage, however, "Hindustán" is limited either to that portion of the peninsula lying north of the Vindya mountains, or yet more strictly to the upper basin of the Ganges where Hindí is the spoken language. The "East Indies," as opposed to the "West Indies," is an old-fashioned and inaccurate phrase, dating from the dawn of maritime discovery, and still lingering in certain parliamentary papers. "India," the abstract form of a word derived through the Greeks from the Persicized form of the Sanskrit *sindhu*, a "river," preëminently the Indus, has become familiar since the British acquired the country, and is now officially recognized in the imperial title of the sovereign.

India, as thus defined, is the middle of the three irregularly shaped peninsulas which jut out southward from the mainland of Asia, thus corresponding roughly to the peninsula of Italy in the map of Europe. Its form is that of a great triangle, with its base resting upon the Himálayan range, and its apex running far into the ocean. The chief part of its western side is washed by the Arabian Sea, and the chief part of its eastern side by the Bay of Bengal. It extends from the eighth to the thirty-fifth degree of north latitude, that is to say, from the hottest regions of the equator to far within the temperate zone. The capital, Calcutta, lies in 88° E. longitude; so that when the sun sets at six o'clock there, it is just past mid-day in England, and early morning in New York. The length of India from north to south, and its greatest breadth from east to west, are both about 1,900 miles; but the triangle tapers with a pear-shaped curve to a point at Cape Comorin, its southern extremity. To this compact dominion the English have added, under the name of British Burmah, the strip of country on the eastern shores of the Bay of Bengal. But on the other hand, the adjacent island of Ceylon has been artificially severed, and placed under the colonial office. Two groups of islands in the Bay of Bengal, the Andamans and the Nicobars; one group in the Arabian Sea, the Laccá-

dives; and the outlying station of Aden at the mouth of the Red Sea, are all politically included with the Indian empire; while dots on the shore of the peninsula itself, representing Portuguese and French settlements, break at intervals the continuous line of British territory.

India is shut off from the rest of Asia on the north by a vast mountainous region, known in the aggregate as the Himálayas, amid which lie the independent states of Bhután and Nepál, with the great table-land of Tibet behind. The native principality of Kashmír occupies the northwestern angle of India, with Eastern Turkestan stretching to the north beyond it. At this northwestern angle the mountains curve southward, and India is separated by the well-marked ranges of the Sufed Koh and Suláimán from Afghánistán; and by a southern continuation of lower hills (the Hálas, etc.) from Baluchistán. The last part of the western land frontier of India is formed by the river Hab, and the boundary ends at Cape Monze, at the mouth of its estuary. Still farther southward India is bounded along the west and southwest by the Arabian Sea and the Indian Ocean. Turning northward from the southern extremity at Cape Comorin, the long sea-line of the Bay of Bengal forms the main part of its eastern boundary. But on the northeast, as on the northwest, India has again a land frontier. The Himálayan ranges at the northeastern angle throw off spurs and chains to the southeast. These spurs, which have been but imperfectly explored, and may possibly constitute an independent mountain system, separate the British provinces of Assam and Eastern Bengal from Independent Burmah. Up to this point, the eastern frontier follows, generally speaking, the watershed which divides the river systems of the Brahmaputra, Meghna, Kuladan (Koladyne), etc., in Bengal and British Burmah, from the Irawadi basin in Independent Burmah. But from near the base of the Myeng-mateng Mountain, the British frontier stretches almost due east, in an artificial line which divides the lower districts and delta of the Irawadi in British Burmah from the middle and upper districts of that river in Independent Burmah. Stretching southeastward from the delta of the Irawadi, a confused succession of little-explored ranges separates the British province of Tenasserim from the native kingdom of Siam. The boundary line runs down to Point Victoria at the extremity of Tenassarim, following in a somewhat rough manner the watershed between the rivers of the British territory on the west and of Siam on the east.

The empire included within these boundaries is rich in varieties of scenery and climate, from the highest mountains in the world to vast river deltas raised only a few inches above the level of the sea. It forms a continent rather than a country. But if we could look down on the whole from a balloon, we should find that India consists of three separate and well-defined tracts. The first includes the lofty Himálaya mountains, which shut it out from the rest of Asia; and which, although for the most part beyond the British frontier, form an overruling factor in the physical geography of northern India. The second region stretches southward from the base of the Himálayas, and comprises the plains of the great rivers which issue from them. The third region slopes upward again from the edge of the river plains, and consists of a high three-sided table-land, supported by the Vindhya mountains on the north, and by the Eastern and Western Gháts, which run down the coast on either side till they meet at a point near Cape Comorin. The interior three-sided table-land thus inclosed is broken by peaks and ranges, interspersed with broad expanses of level uplands, and covers the whole southern half of the peninsula.

The first of the three regions is the Himálaya mount-

ains and their offshoots to the southward. The Himálayas—literally, the “Dwelling-place of Snow,” from the Sanskrit *hima*, frost (Latin, *hiems*, winter), and *álaya*, a house—comprise a system of stupendous ranges, the loftiest in the world. They are the *Emodus* of Ptolemy (among other names), and extend in the shape of a scimitar, with its edge facing southward, for a distance of 1,500 miles along the northern frontier of India. At the northeastern angle of that frontier, the Dihang river, the connecting link between the Tsanpu (Sangpu) of Tibet and the Brahmaputra of Assam, bursts through the main axis of the range. At the opposite or northwestern angle, the Indus in like manner pierces the Himálayas, and turns southward on its course through the Punjab. The Himálayan region has been fully described in a separate article.

This wild region is in many parts impenetrable to man, and nowhere yields a passage for a modern army. It should be mentioned, however, that the Chinese outposts extend as far as a point only 6,000 feet above the Gangetic plain, north of Khatmandu. Indeed, Chinese armies have seriously threatened Khatmandu itself; and Sir David Ochterlony's advance from the plains of Bengal to that city in 1816 is a matter of history. Ancient and well-known trade routes exist, by means of which merchandise from the Punjab finds its way over heights of 18,000 feet into Eastern Turkestan and Tibet. The Muztagh (Snowy Mountain), the Karakoram (Black Mountain), and the Changchenmo are the most famous of these passes.

The Himálayas not only form a double wall along the north of India, but at both their eastern and western extremities send out ranges to the south, which protect its northeastern and northwestern frontiers. On the northeast, those offshoots, under the name of the Nágá and Patkoi mountains, etc., form a barrier between the civilized British districts and the wild tribes of Upper Burmah. The southern continuations of these ranges, known as the Yomas, separate British from Independent Burmah, and are crossed by passes, the most historic of which, the Aeng or An, rises to 4,668 (formerly given at 4,517) feet, with gradients of 472 feet to the mile.

On the opposite or northwestern frontier of India, the mountainous offshoots run down the entire length of the British boundaries from the Himálayas to the sea. As they proceed southward, their best marked ranges are in turn known as the Sufed Koh, the Suláimán, and the Hála mountains.

The wide plains watered by the Himálayan rivers form the second of the three regions into which we have divided India. They extend from the Bay of Bengal on the east to the Afghán frontier and Arabian Sea on the west, and contain the richest and most densely crowded provinces of the empire. One set of invaders after another has from prehistoric times entered by the passes at their eastern and northwestern frontiers. They followed the courses of the rivers, and pushed the earlier comers southward before them toward the sea. About 150,000,000 of people now live on and around these river plains, in the provinces known as the lieutenant-governorship of Bengal, Assam, the Northwestern Provinces and Oudh, the Punjab, Sind, Rájputána, and other native states.

The vast level tract which thus covers northern India is watered by three distinct river systems. One of these systems takes its rise in the hollow trough beyond the Himálayas, and issues through their western ranges upon the Punjab as the Sutlej and Indus. The second of the three river systems also takes its rise beyond the double wall of the Himálayas, not very far from the sources of the Indus and the Sutlej. It turns, however,

almost due east instead of west, enters India at the eastern extremity of the Himálayas, and becomes the Brahmaputra of Assam and Eastern Bengal. These rivers collect the drainage of the northern slopes of the Himálayas, and convey it, by long and tortuous although opposite routes, into India. Indeed, the special feature of the Himálayas is that they send down the rainfall from their northern as well as from their southern slopes to the Indian plains. Of three great rivers of northern India, the two longest, namely, the Indus with its feeder the Sutlej and the Brahmaputra, take their rise in the trough on the north of the Himálayas. The third river system of northern India receives the drainage of their southern slopes, and eventually unites into the mighty stream of the Ganges. In this way the rainfall, alike from the northern and southern slopes of the Himálayas, pours down into the river plains of Bengal.

Throughout the river plains of northern India, two harvests, and in some provinces three, are reaped each year. These crops are not necessarily taken from the same land; but in many districts the best fields have to yield two harvests within the twelve months. In Lower Bengal, peas, pulses, oil-seeds, and green crops of various sorts are reaped in spring; the early rice crops in September; the great rice harvest of the year, and other grains, in November and December. Before these last have been gathered in, it is time to prepare the ground for the spring crops, and the Bengal husbandman knows no rest except during the hot weeks of May, when he is anxiously waiting for the rains. But it should always be remembered that rice is the staple crop in only a limited area of India, and that it forms the everyday food of only a comparatively small proportion of the population. It has been estimated that, in the absence of irrigation, the rice crop requires an annual rainfall of at least thirty-six inches; and an Indian province requires an average fall of not less than fifty or sixty inches in order to grow rice as its staple crop. A line might almost be drawn across Behar, to the north of which the food of the people ceases to be rice and becomes wheat and millets, etc. There are, indeed, great rice-growing tracts in irrigated or low-lying districts of northwestern India, but their produce is consumed by the richer classes or exported.

In the northern and drier regions along the upper courses of the rivers, the country rises gently from their channels in fertile undulations, dotted with mud villages and adorned with noble trees. Mango groves scent the air with their blossom in spring, and yield their abundant fruit in summer. The spreading banyan, with its colonnades of hanging roots; the stately *pipal*, with its green masses of foliage; the leafless wild cotton-tree, glowing with heavy crimson flowers; the tall, feathery tamarind, and the quick-growing *bábul*, rear their heads above the fields. As the rivers approach the coast, the palms begin to take possession of the scene. The ordinary landscape in the delta is a flat stretch of rice fields, fringed around with evergreen masses of bamboos, cocoanuts, date-trees, areca, and other coroneted palms. This densely peopled tract seems at first sight bare of villages, for each hamlet is hidden away amid its own grove of plantains and wealth-giving trees. The bamboo and cocoanut play a conspicuous part in the industrial life of the people; and the number of products derived from them, including rope, oil, food, and timber, has been dwelt on with admiration by many writers.

The crops also change as we sail down the rivers. In the north, the principal grains are wheat, barley, Indian corn, and a variety of millets, such as *joár* (*Holcus Sorghum*) and *bájra* (*Holcus spicatus*). In the delta,

on the other hand, rice is the staple crop and the universal diet. In a single district, Rangpur, 295 separate kinds of rice are known to the peasant, who has learned to grow his favorite crop in every locality, from the solid field, which yields the *áman* harvest, to the swamps twelve feet deep, on the surface of whose waters the rice ears may be seen struggling upward for air. Sugar-cane, oil-seeds, flax, mustard, sesamum, palm-christi, cotton, tobacco, indigo, safflower, turmeric, ginger, coriander, capsicum, cummin, and many precious spices and dyes are grown both in the Northwestern or Upper Provinces, and in the moister valleys and delta of Lower Bengal. A whole pharmacopœia of native medicines, from the well-known aloe and castor-oil to obscure but valuable febrifuges, is derived from shrubs, herbs, and roots. Resins, gums, varnishes, scents, and a hundred articles of commerce or luxury are collected in the fields or forests. Vegetables of many sorts, both indigenous and imported from Europe, form a large part of the food of the people. The melon and huge yellow pumpkin spread themselves over the thatched roofs; fields of potatoes, yams, and *brinjal* are attached to the homesteads. The tea-plant is reared on the hilly ranges that skirt the plains both in the northwest and in Assam; the opium poppy about half down the Ganges, around Benares and Patná; the silkworm mulberry still farther down in Lower Bengal; while the jute fiber is essentially a crop of the delta, and would exhaust any soil not fertilized by river floods. Even the jungles yield the costly lac dye and *tasar* silk cocoons. The *mahuá*, also a product of the jungle, produces the fleshy flowers which form a staple article of food among the hill tribes, and when distilled supply a cheap spirit. The *sál*, *sissu*, *tín*, and many other indigenous trees yield excellent timber. Flowering creepers, of gigantic size and gorgeous colors, festoon the jungle; while each tank bears its own beautiful crop of the lotus and water-lilies. Nearly every vegetable product that feeds and clothes a people, or enables it to trade with foreign countries, abounds.

We come now to the third division of India, namely, the three-sided table-land which covers the southern half or more strictly peninsular portion of India. This tract, known in ancient times as the Deccan, literally "the right hand or south," comprises the Central Provinces, Berar, Madras, Bombay, and the native territories of the Nizám, Sindhia, Holkar, with Mysore and other feudatory states. It had in 1872 an aggregate population of over 90,000,000. For the sake of easy remembrance, therefore, we may take the inhabitants of the river plains in the north to be now nearly 150,000,000, and those of the southern three-sided table-land at 115,000,000. The Deccan, in its local acceptance, is restricted to the high tract between the Nerbadá (Nerbudda) and the Kistná rivers; but it is popularly understood to include the whole country south of the Vindhya as far as Cape Comorin. It slopes up from the southern edge of the Gangetic plains. Three ranges of hills support its northern, its eastern, and its western sides; and the last two meet at a sharp angle near Cape Comorin.

The northern side rests on confused ranges, running with a general direction of east to west, and known in the aggregate as the Vindhya mountains. The Vindhya, however, are made up of several distinct hill systems. Two sacred peaks guard the flanks in the extreme east and west, with a succession of ranges stretching 800 miles between. At the western extremity, Mount Abu, famous for its exquisite Jain temples, rises, as a solitary outpost of the Aravalli hills, 5,650 feet above the Rájputána plain, like an island out of the sea. Beyond the southern limits of that plain, the Vindhya

range of modern geography runs almost due east from Guzerat, forming the northern wall of the Narbadá valley. The Sátpura mountains stretch also east and west to the south of that river, and form the watershed between it and Tápti. Toward the heart of India the eastern extremities of these two converge in the highlands of the Central Provinces and their lofty level plains. Passing still farther east, the hill system finds a continuation in the Káimur range and its congeners, which eventually end in the outlying peaks and spurs that form the western boundary of Lower Bengal, and abut on the old course of the Ganges under the name of the Rájmahál hills. On the extreme east, Mount Páras-náth—like Mount Abu on the extreme west, sacred to Jain rites—rises to 4,400 feet above the level of the Gangetic plains. The various ranges of the Vindhya, from 1,500 to over 4,000 feet high, form, as it were, the northern wall and buttresses which support the central table-land. Though now pierced by road and railway, they stood in former times as a barrier of mountain and jungle between northern and southern India, and formed one of the main obstructions to welding the whole into an empire. They consist of vast masses of forests, ridges, and peaks, broken by cultivated valleys and broad high-lying plains.

The other two sides of the elevated southern triangle are known as the Eastern and Western Gháts. These start southward from the eastern and western extremities of the Vindhya system, and run along the eastern and western coasts of India. The Eastern Gháts stretch in fragmentary spurs and ranges down the Madras Presidency, here and there receding inland and leaving broad level tracts between their base and the coast. The Western Gháts form the great sea-wall of the Bombay presidency, with only a narrow strip between them and the shore. In many parts they rise in magnificent precipices and headlands out of the ocean, and truly look like colossal "passes or landing-stairs" (*gháts*) from the sea.

The physical geography and the political destiny of the two sides of the Indian peninsula have been determined by the characteristics of the mountain ranges on either coast. On the east, the country is comparatively open, and was everywhere accessible to the spread of civilization. On the east, therefore, the ancient dynasties of southern India fixed their capitals. Along the west, only a narrow strip of lowland intervenes between the barrier range and the seaboard. The inhabitants of those tracts remained apart from the civilization of the eastern coast. To this day one of their ruling races, the Nairs, retain land-tenures and social customs, such as polyandry, which mark a much ruder stage of human advancement than Hinduism, and in other parts of India only linger among isolated hill tribes. On the other hand, the people of the western coast enjoy a bountiful rainfall, unknown in the inner plateau and the east. The monsoon dashes its rain-laden clouds against the Western Gháts, and pours from 100 to 250 inches of rain upon their maritime slopes from Khándesh down to Malabar. By the time that the monsoon has crossed the Western Gháts, it has dropped the greater part of its aqueous burden, and central districts, such as Bangalore, obtain only about thirty-five inches. The eastern coast also receives a monsoon of its own; but, except in the neighborhood of the sea, the rainfall throughout the Madras presidency is scanty, seldom exceeding forty inches in the year. The deltas of the three great rivers along the Madras coast form, of course, tracts of inexhaustible fertility; and much is done by irrigation on the thirsty inland plateau to husband and utilize both the local rainfall and the accumulated waters which the rivers bring down.

Of the three regions of India, now briefly surveyed, the first, or the Himálayas, lies for the most part beyond the British frontier, but a knowledge of it supplies the key to the ethnology and history of India. The second region, or the great river plains in the north, formed the theater of the ancient race-movements which shaped the civilization and the political destinies of the whole Indian peninsula. The third region, or the triangular table-land in the south, has a character quite distinct from either of the other two divisions, and a population which is now working out a separate development of its own. Broadly speaking, the Himálayas are peopled by Turanian tribes; the great river plains of Hindustán are still the home of the Aryan race; the triangular table-land has formed an arena for a long struggle between that gifted race from the north and what is known as the Dravidian stock in the south.

To this vast empire the English have now added all Burmah, consisting of the entire valley of the Irawadi (Irrawaddy) with its delta, and a long, flat strip stretching down the eastern side of the Bay of Bengal. Between the narrow maritime tract and the Irawadi runs a backbone of lofty ranges. These ranges, known as the Yoma (Roma) mountains, are covered with dense forests, and both historically and geographically separate the Irawadi valley from the strip of coast. The Yoma (Roma) ranges have peaks exceeding 4,000 feet, and culminate in the Blue Mountain (7,100 feet). They are crossed by passes, one of which, the An or Aeng, rises to 4,668 feet above the sea-level. A thousand creeks indent the seaboard; and the whole of the level country, both on the coast and in the Irawadi valley, forms one vast rice-field. The river floats down an abundant supply of teak and bamboos from the north. Tobacco, of an excellent quality, supplies the little cigars which all Burmese (men, women and children) smoke. Arakan and Pegu, or the provinces of the coast strip and the Irawadi valley, contain mineral oil-springs. Tenasserim forms a long, narrow maritime province, which runs from the mouths of the Irawadi southward to Point Victoria, where the British territory adjoins Siam. It is rich in tin mines, and contains iron ores equal to the finest Swedish, besides gold and copper in smaller quantities, and a very pure limestone. Rice and timber form the staple exports of Burmah; and rice is also the universal food of the people. Burmah, since the acquisition of the native territory in 1886, contains a total area of 280,000 square miles, and a population of at least 10,000,000.

Unlike many other large geographical areas, India is remarkable for having no distinctive botanical features peculiar to itself. It differs conspicuously in this respect from such countries as Australia or South Africa. Its vegetation is in point of fact of a composite character, and is constituted by the meeting and more or less blending of adjoining floras—of those of Persia and the southeastern Mediterranean area to the northwest, of Siberia to the north, of China to the east, and of Malaya to the southeast.

First among the wild animals of India must be mentioned the lion, which is known to have been not uncommon within historical times in Hindustán Proper and the Punjab. At present, the lion is supposed to be confined to the sandy deserts of Guzerat. A peculiar variety is there found, marked by the absence of a mane; but whether this variety deserves to be classed as a distinct species naturalists are not yet determined. The former extent of the lion's range, or at least the degree to which its presence impressed the imagination, may be inferred from the common personal names, Sinh or Sing, Sher, and Hyder, which all signify "lion." The characteristic beast of prey in India is the

tiger, which is found in every part of the country from the slopes of the Himálayas to the Sundarban swamps. Sir Joseph Fayrer, the highest living authority on this subject, believes that twelve feet is the maximum length of the tiger, when measured from nose to tip of tail immediately after death. The advance of cultivation, even more than the incessant attacks of sportsmen, has gradually caused the tiger to become a rare animal in large tracts of country; but it is scarcely probable that he will ever be exterminated from India. His favorite food appears to be deer, antelope, and wild hog. When these abound he will disregard domestic cattle. Indeed, the natives are disposed to consider him as in some sort their protector, as he saves their crops from destruction by the wild animals on which he feeds. But when once he develops a taste for human blood, then the slaughter he works becomes truly formidable. The confirmed man-eater, which is generally an old beast, disabled from overtaking his usual prey, seems to accumulate his tale of victims in sheer cruelty rather than for food. A single tiger is known to have killed 108 people in the course of three years. Another killed an average of about eighty persons per annum. A third caused thirteen villages to be abandoned, and 250 square miles of land to be thrown out of cultivation. A fourth, so late as 1869, killed 127 people, and stopped a public road for many weeks, until the opportune arrival of an English sportsman, who at last killed him. Such cases are, of course, exceptional, and generally refer to a period long past, but they explain and justify the superstitious awe with which the tiger is regarded by the natives. The favorite mode of shooting the tiger is from the back of elephants, or from elevated platforms (*macháns*) of boughs in the jungle. In Central India they are shot on foot. In Assam they are sometimes speared from boats, and in the Himálayas they are said to be ensnared by birdlime. Rewards are given by government to native *shikáris* for the heads of tigers, varying in time and place according to the need. In 1877, 819 persons and 16,137 cattle were reported to have been killed by tigers; on the other side of the account, 1,579 tigers were reported slain, and £3,777 was paid in rewards. The leopard or panther is far more common than the tiger in all parts of India, and at least equally destructive to life and property. The greatest length of the leopard is about seven feet six inches. A black variety, as beautiful as it is rare, is sometimes found in the extreme south of the peninsula, and also in Java. The cheetah or hunting leopard (*Gueparda jubata*) must be carefully distinguished from the leopard proper. This animal appears to be a native only of the Deccan, where it is trained for hunting the antelope. In some respects it approaches the dog more nearly than the cat tribe. Its limbs are long, its hair rough, and its claws blunt and only partially retractile. The speed with which it bounds upon its prey, when loosed from the cart, exceeds the swiftness of any other mammal. If it misses its first attack, it scarcely ever attempts to follow, but returns to its master.

Wolves abound throughout the open country, but are rare in the wooded districts. Their favorite prey is sheep, but they are also said to run down antelopes and hares, or rather catch them by lying in ambush. Instances of their attacking man are not uncommon. In 1827 upward of thirty children were carried off by wolves in a single *parganá*; and the story of Romulus and Remus has had its counterpart in India within recent times. The Indian wolf has a dingy, reddish-white fur, some of the hairs being tipped with black. By some naturalists it is regarded as a distinct species, under the name of *Canis pallipes*. Three distinct varieties, the white, the red, and the black wolf are found

in the Tibetan Himálayas. The Indian fox is comparatively rare, but the jackal abounds everywhere, making night hideous by its never-to-be-forgotten yells. The jackal and not the fox is usually the animal hunted by the packs of hounds occasionally kept by Europeans. The wild dog or dhole is found in all the wilder jungles of India, including Assam and British Burmah. Its characteristic is that it hunts in packs, sometimes containing thirty dogs, and does not give tongue. When once a pack of wild dogs has put up any animal, whether deer or tiger, that animal's doom is sealed. They do not leave it for days, and finally bring it to bay or run it down exhausted. These wild dogs have sometimes been half domesticated, and trained to hunt for the use of man. A peculiar variety of wild dog exists in the Karen hills of Burmah, thus described from a specimen in confinement. It was black and white, as hairy as a Skye terrier, and as large as a medium-sized spaniel. It had an invariable habit of digging a hole in the ground, into which it crawled backward, remaining there all day with only its nose and ferrety eyes visible. Among other dogs of India are the pariah, which is merely a mongrel run wild and half starved; the poligar dog, an immense creature peculiar to the south; the greyhound, used for coursing; and the mastiff of Tibet and Bhután. The striped hyena is common, being found wherever the wolf is absent. Like the wolf, it is very destructive both to the flocks and to children.

Of bears, the common black or sloth bear is common throughout India, wherever rocky hills and forests occur. It is distinguished by a white horseshoe mark on its breast. Its food consists of ants, honey and fruit. When disturbed it will attack man, and it is a dangerous antagonist, for it always strikes at the face. The Himálayan or Tibetan sun bear is found along the north from the Punjab to Assam. During the summer it remains high up in the mountains, near the limit of snow, but in the winter it descends to 5,000 feet and even lower. Its congener, the Malayan sun bear, is found in British Burmah, where also there is a smaller species, and a very large animal reported to be as big as the American grizzly.

The elephant is found in many parts of India, though not in the northwest. Contrary to what might be anticipated from its size and from the habits of its African cousin, the Indian elephant is now, at any rate, an inhabitant, not of the plains, but of the hills; and even on the hills it is usually found among the higher ridges and plateaus, and not in the valleys. From the peninsula of India the elephant has been gradually exterminated, being only found now in the primeval forests of Coorg, Mysore, and Travancore, and in the tributary states of Orissa. It still exists in considerable number along the *taráí* or submontane fringe of the Himálayas. The main source of supply at the present time is the confused mass of hills which forms the northeast boundary of British India, from Assam to Burmah. Two varieties are there distinguished, the *gunda* or tusker, and the *makna* or *hine*, which has no tusks. The reports of the height of the elephant, like those of its intelligence, seem to be exaggerated. The maximum is probably twelve feet. If hunted, the elephant must be attacked on foot, and the sport is therefore dangerous, especially as the animal has but few parts vulnerable to a bullet. The regular mode of catching elephants is by means of a *kheda* or gigantic stockade, into which a wild herd is driven, then starved into submission, and tamed by animals already domesticated. The practice of capturing them in pitfalls is discouraged as cruel and wasteful. Elephants now form a government monopoly everywhere in India. The shooting of them is prohibited, except when they become dangerous to man or de-

destructive to the crops; and the right of capturing them is only leased out upon conditions. A special law, under the title of "The Elephants Preservation Act" (No. VI. of 1879), regulates this licensing system. Whoever kills, captures, or injures an elephant, or attempts to do so, without a license, is punishable by a fine of 500 rupees for the first offense; and a similar fine, together with six months' imprisonment, for a second offense. In the year 1877-78 a total of 264 elephants were captured in the province of Assam, yielding to government a revenue of £3,600. Though the supply is decreasing, elephants continue to be in great demand. Their chief use is in the timber trade, and for government transport. They are also bought up by native chiefs at high prices for purposes of ostentation. Of the rhinoceros, four distinct varieties are enumerated, two with a single and two with a double horn. The most familiar is the *Rhinoceros unicornis*, commonly found in the Brahmaputra valley and in the Sundarbans. It has but one horn, and is covered with massive folds of naked skin. It sometimes attains a height of six feet; its horn, which is much prized by the natives for medicinal purposes, seldom exceeds fourteen inches in length. It frequents swampy, shady spots, and wallows in mud like a pig. The inveterate antipathy of the rhinoceros to the elephant seems to be mythical. The Javan rhinoceros is found in the same localities. It also has but one horn, and mainly differs from the foregoing in being smaller, and having less prominent "shields." The Sumatran rhinoceros is found from Chittagong southward through Burmah. It has two horns and a bristly coat. The hairy-eared rhinoceros is only known from a specimen captured at Chittagong.

The wild hog is well known as affording the most exciting sport in the world—"pig-sticking." It frequents cultivated situations, and is the most mischievous enemy of the villager. A rare animal, called the pigmy hog, exists in the *tarái* of Nepal and Sikkim, and has been shot in Assam. Its height is only ten inches, and its weight does not exceed twelve pounds.

The wild ass is confined to the sandy deserts of Sind and Kachh (Cutch), where, from its speed and timidity, it is almost unapproachable.

Many wild species of the sheep and goat tribe are to be found in the Himálayan ranges.

The antelope tribe is represented by comparatively few species, as compared with the great number peculiar to Africa.

The king of the deer tribe is the *sámbar*, or *gerau*, erroneously called "elk" by sportsmen. It is found on the forest-clad hills in all parts of the country. It is of a deep-brown color, with hair on its neck almost like a mane; and it stands nearly five feet high, with spreading antlers nearly three feet in length. Next in size is the swamp deer or *bara-singha*, signifying "twelve points," which is common in Lower Bengal and Assam. The *chital* or spotted deer is generally admitted to be the most beautiful inhabitant of the Indian jungles.

The ox tribe is represented in India by some of its noblest species. The *gaur*, the "bison" of sportsmen, is found in all the hill jungles of the country, in the Western Gháts, in Central India, in Assam, and in British Burmah. This animal sometimes attains the height of twenty hands (close on seven feet), measuring from the hump above the shoulder. Its short curved horns and skull are enormously massive. Its color is dark chestnut, or coffee-brown. From the difficult nature of its habitat, and from the ferocity with which it charges an enemy, the pursuit of the bison is no less dangerous and no less exciting than that of the tiger or the elephant. The wild buffalo (*Bubalus arni*) differs from the tame buffalo only in being larger and more

fierce. The finest specimens come from Assam and Burmah.

The rat and mouse family is only too numerous. Conspicuous in it is the loathsome bandicoot, which sometimes measures two feet in length, including its tail, and weighs three pounds. It burrows under houses, and is very destructive to plants, fruit, and even poultry. More interesting is the tree rat, a native of Bengal, about seven inches long, which makes its nest in coconut palms and bamboos. The voles or field mice (genus *Arvicola*) occasionally multiply so exceedingly as to diminish the out-turn of the local harvest, and to require special measures to be organized for their suppression.

The ornithology of India, though it is not considered so rich in specimens of gorgeous and variegated plumage as that of other tropical regions, contains many splendid and curious varieties. Some are clothed in nature's gay attire, others distinguished by strength, size, and fierceness. The parrot tribe is the most remarkable for beauty.

The serpent tribe in India is numerous; they swarm in all the gardens, and intrude into the dwellings of the inhabitants, especially in the rainy season. Most are comparatively harmless, but the bite of others is speedily fatal. The cobra di capello (*Naga tripudians*)—the name given to it by the Portuguese, from the appearance of a hood which it produces by the expanded skin about the neck—is the most dreaded. It seldom exceeds three or four feet in length, and is about an inch and a quarter thick, with a small head, covered on the forepart with large smooth scales; it is of a pale brown color above, and the belly is of a bluish-white tinged with pale brown or yellow. The Russelian snake (*Daboia russellii*), about four feet in length, is of a pale yellowish-brown, beautifully variegated with large oval spots of deep brown, with a white edging. Its bite is extremely fatal. Itinerant showmen carry about these serpents, and cause them to assume a dancing motion for the amusement of the spectators. They also give out that they render snakes harmless by the use of charms or music—in reality it is by extracting the venomous fangs. But, judging from the frequent accidents which occur, they sometimes dispense with this precaution. All the salt-water snakes in India are poisonous, while the fresh-water forms are wholly innocuous. Sir J. Fayrer has demonstrated that there is no cure for the bite of the cobra, if the snake is full-grown, and if its poison fang is full and is not interfered with by clothing. The most hopeful remedy in all cases of snake bite is the injection of ammonia. The loss of life from this cause in India is painful to contemplate, nor does any means of diminishing the evil seem feasible. It is impossible to exterminate poisonous snakes altogether, even in England. In India the impossibility is yet more evident, from the greater number of the snakes, the character of the country, and the scruples of the people. Something, however, is being effected by the offer of rewards. In 1877 a total of 16,777 persons are reported to have been killed by snakes, as compared with only 819 by tigers.

The other reptiles include two varieties of crocodile and the gavial. These are more ugly in appearance than destructive to human life. Scorpions also abound.

All the waters of India—the sea, the rivers, and the tanks—swarm with a great variety of fishes, which are caught in every conceivable way, and furnish a considerable proportion of the food of the poorer classes.

The insect tribes in India may be truly said to be innumerable; nor has anything like a complete classification been given of them in the most scientific treatises. The heat and the rains give incredible activity to noxious

or troublesome insects, and to others of a more showy class, whose large wings surpass in brilliancy the most splendid colors of art. Stinging mosquitoes are innumerable, and moths and ants of the most destructive kind, as well as others equally noxious and disagreeable. Among these which are useful are the bee, the silkworm, and the insect that produces lac. Clouds of locusts occasionally appear, which leave no trace of green behind them, and give the country over which they pass the appearance of a desert.

THE PEOPLE.

The population of India, with Burmah, amounts to 265,000,000, or, as already mentioned, more than double the number which Gibbon estimated for the Roman empire in the height of its power. But the English Government, like the Roman, has respected the rights of native chiefs who are willing to govern peaceably and well, and one-third of the country still remains in the hands of hereditary rulers.

For the first time in the history of India an attempt was made in the years 1871-72 to ascertain the population of the country by actual counting. The results obtained on that occasion, though in certain points they leave much to be desired, may be accepted generally as a tolerable approximation to the truth. Prior to this census, occasional enumerations had been made, with varying degrees of accuracy, in some of the provinces; while in others mere conjectural estimates had been allowed to pass uncriticised. In Bengal, for example, where statistical inquiry was in a backward state, the government had year by year accepted a loose estimate of 42,000,000 for the population under its control, and based upon this all its calculations for legislation and finance. The census of 1872 disclosed a total of nearly 67,000,000 for Bengal and Assam, being an increase upon the estimate of more than one-half. In Berar, or the Assigned Districts of Hyderabad, a census had been taken in 1867, in the Punjab in 1868, and in Oudh in 1869. In these provinces, therefore, it was considered impolitic to trouble the people by a fresh enumeration. Throughout all the rest of India under British administration, including the native state of Mysore, a general census was effected on uniform principles, which may be said to have begun in November, 1871, and ended in August, 1872. So far as possible, the work was done in a single night; but in certain remote and uncivilized tracts it was of necessity prolonged over several months. Considering the absolute novelty of the undertaking, at least in some provinces, and the scanty means at the disposal of the authorities, the general accuracy of the results may be regarded with not a little satisfaction. Subsequent local investigations tend to show that the numbers were under rather than overstated. In a few cases paid enumerators were engaged; but generally the work was left to the ordinary staff of each district, assisted by the police, the landlords, and their agents. The total expenditure throughout all British India was only £82,203, being at the rate of less than half a farthing per head. The suspicions of the ignorant villagers were naturally aroused by the counting, which they imagined to be preliminary to some fresh exaction by the Sarkár or government. Only in two or three cases was any real opposition offered; and there is little reason to believe that any material evasion was accomplished. The results of this enumeration are here given:

"The total population of British India was ascertained to amount to 191,096,603 persons, on an area of 898,381 square miles, being an average of 212 persons per square mile. Deducting the frontier province of Assam and British Burmah beyond the sea, the average

is 243 persons per square mile. The population of the several native states is returned, partly from actual enumeration and partly from mere guessing, at 49,155,746 persons, on an area of 575,265 square miles, being an average of eighty-five persons to the square mile. The French possessions have an area of 178 square miles and a population of 271,460 persons; the Portuguese possessions, 1,086 square miles and 407,712 persons." The aggregate figures for all India at the present time (1890) are 1,474,910 square miles and 265,670,000 persons.

The schedules of the census fail entirely to give a satisfactory classification of the races among which the vast population of India is divided. Using language as our criterion, the people might perhaps be arranged in five classes—(1) The old races of the south, known as the Dravidian stock, which includes, not only the great peoples using the literary languages of Tamil, Telugu, Malayálam, and Kanarese, but also scattered tribes speaking dialects of the same family, who are found as far north as the hills of Chutiá Nágpur; (2) the hill tribes of Central India, from the Bhils of Bombay to the Santáls of Bengal, whose physical characteristics are negroid, and whose family of languages has received the name of Kolarian; (3) the tribes of Indo-Chinese origin, who inhabit the southern slopes of the Himálayas, the greater part of the Assam valley, and the whole of Burmah; it seems probable that the semi-Hinduized low castes of Northern Bengal also belong to this stock; (4) high-caste Hindus, or that offshoot of the august Aryan race, which has imposed its language, its religion, and its name upon the greater part of the country; (5) successive waves of Mahometan conquerors, Arab, Afghán, Mughal, and Persian, who form in the aggregate but an infinitesimal element in the general population. Whether pure Aryans are now to be traced in any other class than that of the Bráhmans may perhaps be disputed. Even the so-called Rájputs have probably a considerable admixture of Scythic blood. The Vaisya or third caste of Manu's system is admitted to be almost extinct, while his Súdras are to be found in the preëxisting non-Aryan population.

Principal Divisions of the Population.

RACE, ETC.	Number.	Tracts Where Most Numerous.
<i>Hindus.</i>		
Brahmans.....	10,131,541	Northwest Provinces, Oudh, Bengal, Madras.
Rajputs	5,641,138	Northwest Provinces, Bengal, Oudh, Punjab.
Out-castes.....	8,712,998	Madras.
Aboriginal tribes....	17,716,825	Bengal, Central Provinces, Assam.
Native Christians...	595,815	South and West.
<i>Mahometans.</i>		
Mughals....	219,755	Punjab.
Afghans or Pathans.	1,841,693	"
Sayyids	790,984	"
Shaikhs	4,700,320	"
<i>Foreigners.</i>		
Parsis.....	69,000	Bombay city and Surat.
Nepalis	31,000	Bengal.
Manipuris.....	12,000	Assam.
Arabs.....	8,300	Bombay.
Persians.....	3,500	"
Armenians.....	1,250	Bengal.
Chinese	13,300	Burmah.
Malays.....	1,500	"
Jews	7,600	Bombay.
Eurasians and Indo-Portuguese..	108,000	Calcutta, Madras, and Bombay cities.
Europeans.....	121,000	of whom 75,700 are British.

Among Mahometans, who number in all 40,227,552, four classes are commonly distinguished. *Mughals*, or

the descendants of the last conquering race, number only 219,755, of whom nearly half are to be found in the Punjab. *Afgháns* or *Patháns* on the other hand, from their proximity to the frontier, are much more strongly represented, numbering 1,841,693 in all, chiefly in the Punjab and in the Rohilkhand division of the north-west. *Sayyids*, who claim to be lineally descended from the prophet, number 790,984; and *Shaikhs*, 4,700,320. The remainder are unspecified, but the following tribes or classes among Indian Musalmáns are worthy of notice: In Bengal the vast majority of Mahometans manifestly belong to the same race as the lowest castes of Hindus. They are themselves subdivided into many classes, which in their devotion to hereditary occupations are scarcely to be distinguished from Hindu castes. Of late years a reforming spirit has arisen, leading them to abandon the polytheistic customs and festivals which they shared with their Hindu fellow-villagers. In the Punjab, besides the Pathán immigrants from across the frontier, Islam has taken a strong hold of the native population. The census returned upward of 1,300,000 Játs, 700,000 Rájputs, and 424,000 Gujars among the Musalmáns. Here, again, the Mahometans are not strongly distinguished from their Hindu brethren. Baluchis from beyond the frontier number 235,000 in the Punjab, and 145,000 in Sind. Bombay possesses three peculiar classes of Musalmáns, each of which is specially devoted to maritime trade—the *Memons*, numbering 49,000, chiefly in Sind; the *Borahs*, 86,000, mainly in Guzerat; the *Khojahs*, nearly 18,000, of whom half live in the island of Bombay. In southern India the majority are known as Dakhani Musalmáns, being descendants of the armies led by the kings and the nawábs of the Deccan. But the two peculiar races of the south are the *Moplas* (613,000) and the *Labbays* (312,000), both of which are seated along the coast and follow a seafaring life. They are descended from the Arab traders who settled there in very early times, and have been recruited partly by voluntary adhesions and partly by forcible conversions during the persecutions of Hyder Alí and Tipú Sultán. The Moplas of Malabar are notorious for repeated outbreaks of bloody fanaticism.

The Mahometans are most numerous, as might be expected, along the valley of the Indus, from Karáchi (Kurrachee) to Pesháwar. In the Bombay province of Sind they number 78 per cent. of the total population. In the Punjab generally the proportion is 53 per cent., rising to 93 per cent. in the frontier district of Pesháwar. In the Northwestern Provinces, and also in Oudh, the proportion of Mahometans nowhere exceeds 23 per cent., though that part of the country was the seat of successive Musalmán empires for many centuries. In Lower Bengal, on the other hand, the faith of Islam has exercised a more permanent effect upon the population, especially in the valley of the Brahmaputra. The average of Mahometans in the whole province is 33 per cent., rising to 80 per cent. in the deltaic districts of Bográ and Rájsháhí. Here, again, it is found that the Mahometans are not most numerous in the neighborhood of the great Musalmán capitals, Gaur, Rájmahál, Dacca, and Murshidábád, but in the densely populated agricultural tracts, where the semi-aboriginal tribes appear to have willingly embraced Islam in preference to remaining outcasts beyond the exclusive pale of Hinduism.

The Sikhs are almost entirely confined to the Punjab, where they number only 6.50 per cent. of the population. Their stronghold is the country between the rivers Ráví and Sutlej (Satlaj), including the historical cities of Lahore, Amritsar, Ambála (Umballa), and Jalandhar. In no district do they form more than 17 per cent.

Of the total number of 897,682 Christians, about 250,000 are believed to be Europeans or to have European blood in their veins. The south of India is the only part where the exertions of the missionaries can be said to be visible in the statistics of population. In the Madras presidency generally, Christians number 533,760, or 1.71 per cent. of the total. Of these, about 416,000 are returned as Roman Catholics, and about 118,000 as Protestants. Nearly one-fifth of all the Christians are found in the single district of Tinneveli, and they are numerically next strongest in Madura, Tanjore, Trichinopoli, South Kanara and Malabar. Christianity has been known in southern India for many centuries. A Pehlevi inscription in the ancient church of the St. Thomas' Mount near Madras city indicates a settlement of Manichæans or Persian Christians on the eastern coast, as well as on the west; and tradition speaks of the preaching of the apostle St. Thomas in Madras, Tinneveli, and Malabar. The adherents of the Syrian church in Malabar, Travancore, and Cochin are the most ancient Christian community in the south. After these come the Roman Catholics, who trace their origin to the teaching of St. Xavier and the Madura Jesuits. The Protestant churches date only from about the beginning of the present century, but their progress since that time has been considerable. In Bombay there are 126,063 Christians, of whom nearly 83,000, chiefly Indo-Portuguese, are returned as Roman Catholics. In Bengal the Christians number only 90,763, but since the date of the census missionary effort has been very successful among the hill tribes of Chutiá Nágpur. In the Northwestern Provinces there are 22,196 Christians, in the Punjab 22,154, in the Central Provinces 10,477, in Mysore 25,676, in Coorg 2,410, and the remainder are scattered over Assam, Berar, and Ajmír. In British Burmah the Christians are proportionately more numerous than in any other province, amounting to 52,299, or 1.90 per cent., chiefly converts from the hill tribe of Karens. It should be remembered that the above figures are exclusive of the native states, in which the Christians amount to about 700,000, making a total in round numbers of 1,500,000 for all India.

AGRICULTURE.

The cultivation of the soil is the occupation of the Indian people, in a sense which is difficult to realize in England, and which cannot be adequately expressed by figures. As the land tax forms the mainstay of the imperial revenue, so the *ráyat* or cultivator constitutes the unit of the social system. The organized village community contains many other members besides the cultivators, but they all exist for his benefit, and all alike are directly maintained from the produce of the village fields. Even in considerable towns, the traders and handicraftsmen almost always possess plots of land of their own, on which they raise sufficient grain to supply their families with food. The operations of rural life are familiar to every class. They are enveloped in a cloud of religious sanctions, and serve to mark out by their recurring periods the annual round of common life. According to the returns of the general census of 1872, the number of adult males engaged in agriculture amounts to nearly 35,000,000, or 56.2 per cent. of the total. To these ought to be added almost all the laborers, an additional 7,500,000, or 12.3 per cent.—thus raising the grand total of persons directly supported by the land to more than two-thirds of the entire number of adult males, besides those indirectly or incidentally connected with it.

But though agriculture thus forms the staple industry of the country, its practice is pursued in different provinces with infinite variety of detail. Everywhere the

same perpetual assiduity is found, but the inherited experience of generations has taught the cultivators to adapt their simple methods to differing circumstances. For irrigation, native patience and ingenuity have devised means which compare favorably with the colossal projects of government. Manure is copiously applied to the more valuable crops whenever manure is available, its use being limited by poverty and not by ignorance. The rotation of crops is not adopted as a principle of cultivation; but in practice it is well known that a succession of exhausting crops cannot be taken in consecutive seasons from the same field, and the advantage of fallows is widely recognized. The periodicity of the seasons usually allows two, and sometimes three, harvests in the year, but not necessarily, nor indeed usually, on the same fields. For inexhaustible fertility, and for retentiveness of moisture in a dry year, no soil in the world can surpass the *regar* or "black cotton soil" of the Deccan. In the broad river basins, the inundations deposit annually a fresh top-dressing of silt, thus superseding the necessity of manures.

The name of rice has from time immemorial been so closely associated with Indian agriculture, that it is difficult to realize how comparatively small an area is planted with this crop. If we except the deltas of the great rivers and the long strip of land fringing the western coast, rice may be called an occasional crop throughout the remainder of the peninsula. But where rice is grown, it is grown to the exclusion of all other crops. In British Burmah, out of a total cultivated area of 2,833,520 acres, as many as 2,554,853 acres, or 90 per cent., are under rice. Independent Burmah, on the other hand, grows no rice, but imports largely from British territory. For Bengal, unfortunately, no general statistics are available. But taking Rangpur as a typical district, it was there found that 1,500,000 acres, out of a classified total of a little over 1,750,000 acres, or 88 per cent., were devoted to rice. Similar proportions hold good for the province of Orissa, the deltas of the Godávari, Kistna, and Káveri (Cauvery), and the lowlands of Travancore, Malabar, Kánara, and the Concan. For the Northwestern Provinces and Oudh, again, no agricultural statistics are available; but though rice, grown in damp localities, or with the help of irrigation, forms a favorite food for the upper classes, the local supply requires to be supplemented by importation from Bengal. Throughout the remainder of the country, except in Assam, which is agriculturally a continuation of the Bengal delta, the cultivation of rice occupies but a subordinate place. The average out-turn per acre in Bengal has been estimated at fifteen *maunds*, or 1,200 pounds of cleaned rice. In the years 1877-78, when famine was raging in southern India, the total exports of rice from Calcutta amounted to more than 16,000,000 hundredweight. In British Burmah there is but a single rice harvest in the year, corresponding to the *áman* of Bengal. The grain is reddish in color and of a coarse quality; but the out-turn is much higher than in Bengal, reaching in some places an average of 2,000 and 2,500 pounds per acre. The annual exports of rice from Burmah amount to about 12,000,000 hundred weight. Besides being practically the sole crop grown in the deltaic swamps, rice is raised in patches in all the hill-valleys, from Coorg to the Himálayas.

Wheat is grown to some extent in almost every district; but, broadly speaking, it may be said that wheat does not thrive where rice does, nor, indeed, anywhere south of the Deccan. The great wheat-growing tract of India is the Punjab, where over 7,000,000 acres, or 37 per cent. of the total cultivated area, are under this crop. For the Northwestern Provinces and Oudh, in default

of actual statistics, it has been estimated that the total area under wheat is as large as in the Punjab, though the relative proportion is less. Wheat is also grown in Behar and in the districts of Bengal that lie south of the Ganges. In the Central Provinces, wheat is grown on 23 per cent. of the cultivated area, being the chief crop in the districts of Hoshangábád, Narsinhpur, and Ságár. In Bombay the corresponding proportion is less than 5 per cent., and in Sind 12 per cent. It has been conjectured that the total area under wheat in India is equal to the area under the same crop in the United States. Nor is the general out-turn contemptible, averaging about thirteen bushels per acre in the Punjab, as compared with an average of fifteen and one-half bushels for the whole of France. The quality, also, of the grain is high enough to satisfy the demands of English millers; and "Calcutta Club No. 1" commands a price in Mark Lane not much below that of the finest Australian or Californian produce. Unfortunately, when a prosperous trade with Europe seemed on the point of establishing itself, the terrible year 1877-78 supervened, and India now has to fight against the position of vantage occupied by the United States. According to the system of classification in Upper India, wheat ranks as a *rabi* or spring crop, being reaped at the close of the cold weather in April and May. Wherever possible, it is irrigated; and the extension of canals through the Gangetic Doáb has largely contributed to the substitution of wheat for inferior cereals.

Taking India as a whole, it may be affirmed that the staple food grain is neither rice nor wheat, but millet, which is probably the most prolific grain in the world, and the best adapted to the vicissitudes of a tropical climate. Excluding the special rice-growing tracts, varieties of millet are grown more extensively than any other crop from Madras, in the south, at least as far as Rájputána, in the north. The two most common kinds are great millet (*Holcus Sorghum* or *Sorghum vulgare*), known as *joár* or *jawári* in the languages derived from the Sanskrit, as *jonna* in Telugu, and as *cholan* in Tamil; and spiked millet (*Holcus spicatus* vel *Penicillaria spicata*), called *bájra* in the north and *kambu* in the south. In Mysore and the neighboring districts *rági* (*Eleusine coracana*), called *náchani* in Bombay, takes the first place. According to the Madras system of classification, these millets all rank as "dry crops," being watered only by the local rainfall, and sown under either monsoon; farther north they are classed with the *kharif* or autumn harvest, as opposed to wheat. Indian corn is cultivated to a limited extent in all parts of the country; barley, in the upper valley of the Ganges, throughout the Punjab, and in Himálayan valleys; oats, only as an experimental crop by Europeans. *Joár* and *rági*, but not *bájra*, are invaluable as fodder for cattle.

Oil-seeds also form an important crop in all parts of the country, being, perhaps, more universally grown than any other, as oil is necessary, according to native customs, for application to the person, for food, and for burning in lamps. In recent years the cultivation of oil-seeds has received an extraordinary stimulus, owing to the demand for export to Europe, especially to France; but as they can be grown after rice, etc., as a second crop, this increase has hardly at all tended to diminish the production of food grains. The four chief varieties grown are mustard or rape seed, linseed, *til* or gingelly (sesamum), and castor oil. Bengal and the Northwestern Provinces are at present the chief sources of supply for the foreign demand, but gingelly is largely exported from Madras, and, to a smaller extent, from Burmah.

Vegetables are everywhere cultivated in garden plots

for household use, and also on a larger scale in the neighborhood of great towns. Among favorite native vegetables, the following may be mentioned: The egg-plant, called *brinjal* or *baigan* (*Solanum Melongena*), potatoes, cabbages, cauliflower, radishes, onions, garlic, turnips, yams, and a great variety of cucurbitaceous plants, including *Cucumis sativus*, *Cucurbita maxima*, *Lagenaria vulgaris*, *Trichosanthes dioica*, and *Benincasa cerifera*. Of these, potatoes, cabbages and turnips are of recent introduction. Almost all English vegetables can be raised by a careful gardener. Potatoes thrive best on the higher elevations, such as the Khásí hills, the Nílگیرis, the Mysore uplands, and the slopes of the Himálayas; but they are also grown even in lowland districts. They were first introduced into the Khásí hills in 1830, and they now constitute the principal crop, the annual export to the Calcutta market being more than 7,000 tons, valued at £50,000.

Among cultivated fruits are the following: Mango (*Mangifera indica*), plantain (*Musa paradisiaca*), pineapple (*Ananassa sativa*), pomegranate (*Punica granatum*), guava (*Psidium pomiferum* et *P. pyriferum*), tamarind (*Tamarindus indica*), jack (*Artocarpus integrifolia*), custard-apple (*Anona squamosa*), pawpaw (*Carica Papaya*), shaddock (*Citrus decumana*), and several varieties of fig, melon, orange, lime, and citron. According to the universal verdict of Europeans, no native fruits can compare with those of England. But the mangoes of Bombay, of Múltán, and of Maldah in Bengal, and the oranges of the Khásí hills, enjoy a high reputation; while the guavas of Madras are made into an excellent preserve.

Among spices, for the preparation of curry and other hot dishes, turmeric and chillies hold the first place, being very generally cultivated. Next in importance come ginger, coriander, aniseed, black cummin, and fenugreek. Pepper proper is confined to the Malabar coast, from Kánara to Travancore. Cardamoms are a valuable crop in the same locality, and also in the Nepálese Himálayas. *Pán* or betel-leaf is grown by a special caste in most parts of the country. Its cultivation requires constant care, but is highly remunerative. Betel-nut or areca is chiefly grown in certain favored localities, such as the deltaic districts of Bengal and the highlands of southern India.

Besides betel-nut (*Areca Catechu*), the palms of India include the cocoa-nut (*Cocos nucifera*), the bastard date (*Phoenix sylvestris*), the palmyra (*Borassus flabelliformis*), and the true date (*Phoenix dactylifera*). The cocoa-nut, which loves a sandy soil and a moist climate, is found in greatest perfection along the strip of coast-line that fringes the west of the peninsula, where it ranks next to rice as the staple product. The bastard date, grown chiefly in the country around Calcutta and in the northeast of the Madras presidency, supplies both the jaggery sugar of commerce and intoxicating liquors for local consumption. Spirit is also distilled from the palmyra, especially in the neighborhood of Bombay and in the southeast of Madras. The true date is almost confined to Sind.

Sugar is manufactured both from the sugar-cane and from the bastard date-palm, but the total production is inadequate to the local demand. The best cane is grown in the Northwestern Provinces, on irrigated land. It is an expensive crop, requiring much attention, and not yielding a return within the year; but the profits are proportionately large. In Bengal the manufacture of sugar for exportation has declined during the century; but in Jessor district the preparation of date-sugar is a thriving and popular industry. The manufacture of sugar is everywhere in the hands of natives, except in the case of the Aska factory in the Madras

district of Ganjám, and the Ashtagrám factory in Mysore. Both these factories, which use sugar-cane and not date, have received honorable notice at exhibitions in Europe.

Cotton holds the first place among agricultural products grown for export. From the earliest times, cotton has been grown in sufficient quantities to meet the local demand, and even in the last century there was some slight export which was carefully fostered by the East India Company. But the present importance of the crop dates only from the crisis in Lancashire caused by the American war. Prior to 1860 the exports of raw cotton from India used to average less than £3,000,000 sterling a year; but after that date they rose by leaps, until in 1866 they reached the enormous total of £37,000,000. Then came the crash, caused by the restoration of peace in the United States, and the exports fell, until they now average little more than £8,000,000 a year. The fact is that Indian cotton has a short staple, and cannot compete with the best American cotton for spinning the finer qualities of yarn. But while the cotton famine was at its height, the cultivators were intelligent enough to make the most of their opportunity. The area under cotton increased enormously, and the growers managed to retain in their own hands a fair share of the profit.

Jute ranks next after cotton as a fiber crop. The extension of its cultivation has been equally rapid, and it is yet more limited in its area, being confined to northern and eastern Bengal. In this tract, which extends from Purniah to Goálpára, north of the Ganges for the most part, and along both banks of the Brahmaputra, jute is grown on almost every variety of soil. The chief characteristic of the cultivation is that it remains entirely under the control of the cultivator. Practically a peasant proprietor, he increases or diminishes his cultivation according to the state of the market, and keeps the profits in his own hands. The demand for jute in Europe has contributed more than any administrative reform to raise the average standard of comfort throughout eastern Bengal. In 1872, when speculation was briskest, it is estimated that about 1,000,000 acres were under jute, distributed over sixteen districts, which had a total cultivable area of 23,000,000 acres. The total export from Calcutta in that year was about 7,000,000 hundredweights, valued at £4,142,548. Both quantities and prices have since somewhat declined, but the business remains on a stable footing.

Indigo, though relatively of less importance than formerly, is still the foremost staple grown by European capital. In Bengal Proper its cultivation has greatly declined since the early years of this century. English planters have abandoned the districts of Húgli (Hooghly), the Twenty-four Parganás, Dacca, Farídpur, Rangpur, and Pabná, which are dotted with the sites of ruined factories. In Nadiyá, Jessor, Murshidábád, and Maldah, the industry is still carried on, but it has not recovered from the depression caused by the indigo riots of 1860, and the emancipation of the peasantry by the Land Act of 1859. Dye of superior quality is manufactured in Midnapur, along the frontier of the hill tracts. But indigo cultivation on the old scale still flourishes in North Behar, from which is derived one-half of the total exports from Calcutta. No accurate statistics of area are available; but in Tirhut alone there are fifty-six principal concerns, with seventy outworks, producing annually about 20,000 *maunds* of dye; in Sáran, thirty principal concerns and twenty-five outworks, producing about 12,000 *maunds*; in Champáran, seven large concerns, producing also 12,000 *maunds*. It has been estimated that the total amount of money annually distributed by the planters of North Behar cannot be

less than £1,000,000. Across the border, in the North-western Provinces, indigo is grown and manufactured to a considerable extent by native cultivators. In the Punjab, also, indigo is an important crop, especially in the districts of Múltán, Muzaffargarh, and Derá Ghází Khán. In Madras, where it is grown and manufactured entirely by the natives, the total area under indigo is about 300,000 acres, chiefly in the northeast of the presidency, extending along the coast from Kistna to South Arcot, and inland to Karnúl and Cuddapah.

The opium of commerce is grown and manufactured in two special tracts—(1) the valley of the Ganges around Patná and Benares, and (2) a fertile table-land in Central India, corresponding to the old kingdom of Málwá, for the most part still under the rule of native chiefs, among whom Sindhia and Holkar rank first. In the latter of these two regions the cultivation of poppy is free, and the duty is levied as the opium passes through the British presidency of Bombay; in the former, the cultivation is a strict government monopoly. Opium is also grown for local consumption throughout Rájputána, and to a very limited extent in the Punjab and the Central Provinces. Throughout the rest of India it is absolutely prohibited. In the Ganges valley, the cultivation is supervised from two agencies, with their headquarters at Patná and Gházípur, at which two towns alone the manufacture is conducted. The amount of opium grown in native states and exported from Bombay is about equal, raising the average exports of opium to about £12,000,000, of which about £7,500,000 represent net profit to government.

Tobacco is grown in every district of India for local consumption. The soil and climate are favorable; but up to the present time the quality of native-cured tobacco is so inferior that it finds no market in Europe. The principal tobacco-growing tracts are Rangpur and Tirhut in Bengal, Kaira and Bombay, and the delta of the Godávari and Coimbatore and Madura districts in Madras. The two last-mentioned districts supply the raw material for the well-known "Trichinopoli cheroot," almost the only form of Indian tobacco that finds any favor with Europeans; the produce of the *lánkás* or alluvial islands in the Godávari is manufactured into "coconadas." The tobacco of northern Bengal is largely exported to British Burmah, for the Burmese, who are great smokers, do not grow sufficient for their own needs. Tobacco is also grown for export in the hill tracts of Chittagong. The tobacco of Tirhut is chiefly exported toward the west. The total area under tobacco in that district is estimated at 40,000 acres, the best quality being grown in *parganá* Saressa of the Tájpur subdivision.

Since 1875 a private firm of capitalists, backed by government support, has begun to grow tobacco and manufacture it for the European market. The scene of operations is two abandoned stud-farms at Gházípur, in the Northwestern Provinces, and at Pusa in the Bengal district of Tirhut. No less than five English or American curers were employed. Some of the produce was exported to England as "cured leaf;" but the larger part was put upon the Indian market in the form of "manufactured smoking mixture." This mixture is in demand at regimental messes and canteens, and has already found its way to Australia. The enterprise may now be said to have passed beyond the stage of experiment, and has probably opened a new sphere alike for Indian agriculture and European capital. The one essential condition of success is skilled supervision in the delicate processes of tobacco-curing.

The cultivation of coffee is confined to southern India, though attempts have been made to introduce the plant both into British Burmah and into the Bengal district

of Chittagong. The coffee tract may be roughly defined as a section of the landward slope of the Western Gháts, extending from Kánara in the north to Travancore in the extreme south. That tract includes almost the whole of Coorg, the districts of Kádur and Hassan in Mysore, and the Nílgi hills, enlarged by the recent annexation of the Wainád. Within the last few years the cultivation has extended to the Shevaroy hills in Salem district, and to the palni hills in Madura.

Unlike tea, coffee was not introduced into India by European enterprise; and even to the present day its cultivation is largely followed by the natives. The Malabar coast has always enjoyed a direct commerce with Arabia, and at an early date gave many converts to Islám. One of these converts, Bába Budan by name, is said to have gone on a pilgrimage to Mecca and to have brought back with him the coffee berry, which he planted on the hill range in Mysore, still called after him. According to local tradition this happened about two centuries ago. The shrubs thus sowed lived on, but the cultivation did not spread until the beginning of the present century. The state of Mysore and the Bába Budan range also witnessed the first opening of a coffee-garden by an English planter about 1840. The success of this experiment led to the extension of coffee cultivation into the neighboring tract of Manjarábád, also in Mysore, and into the Wainád subdivision of the Madras district of Malabar. From 1840 to 1860 the enterprise made slow progress; but since the latter date it has spread with great rapidity along the whole line of the Western Gháts, clearing away the primeval forest, and opening a new era of prosperity to the laboring classes.

The cultivation of tea in India commenced within the memory of men still living in 1890, and the industry now rivals indigo as a field for European capital. Unlike coffee-planting the enterprise owes its origin to the initiation of government, and has never attracted the attention of the natives. Early travelers reported that the tea-plant was indigenous to the southern valleys of the Himálayas; but they were mistaken in the identity of the shrub, which was the *Osyris nepalensis*. The real tea (*Thea viridis*), a plant akin to the camellia, grows wild in Assam, being commonly found throughout the hilly tract between the valleys of the Brahmaputra and the Bákak. There it sometimes attains the dimensions of a large tree; and from that, as well as from other indications, it has been plausibly inferred that Assam is the original home of the plant, which was thence introduced at a prehistoric date into China. The real progress of tea-planting in Assam dates from about 1851, and was greatly assisted by the promulgation of the Wasteland Rules of 1854. By 1859 there were already fifty-one gardens in existence, owned by private individuals; and the enterprise had extended from its original headquarters in Lakhimpur and Síbságar as far down the Brahmaputra as Kámráp. In 1856 the tea-plant was discovered wild in the district of Cáchár in the Bákak valley, and European capital was at once directed to that quarter. At about the same time tea-planting was introduced into the neighborhood of the sanatorium of Dárjiling (Darjeeling), among the Sikkim Himálayas. The success of these undertakings engendered a wild spirit of speculation in tea companies both in India and at home, which reached its climax in 1865. The industry recovered but slowly from the effects of this disastrous crisis, and did not again reach a stable position until 1869. Since that date it has rapidly but steadily progressed, and has been ever opening new fields of enterprise. At the head of the Bay of Bengal in Chittagong district, side by side with coffee on the Nílgi hills, on the forest-clad slopes of Chutiá Nágpur,

amid the low-lying jungle of the Bhután Dwar, and even in Arakan, the energetic pioneers of tea-planting have established their industry. Different degrees of success may have rewarded them, but in no case have they abandoned the struggle. The market for Indian tea is practically inexhaustible. There is no reason to suppose that all the suitable localities for its growth have yet been tried; and we may look forward to the day when India shall not only rival but supersede China in her staple product.

The introduction of the quinine-yielding cinchona into India is a remarkable example of success rewarding the indefatigable exertions of a single man. When Mr. Clements Markham undertook the task of transporting the seedlings from South America in 1860, cinchona had never before been reared artificially. But the novel experiment in arboriculture has not only been successfully conducted, but has proved remunerative from a pecuniary point of view. A cheap febrifuge has been provided, in the form of the mixed cinchona alkaloids, for the fever-stricken population of the Indian plains, while the surplus bark sold in Europe more than repays interest upon the capital expended. These results have been produced from an expenditure of about £100,000. The headquarters of cinchona cultivation are on the Nilgiri hills, where government owns several plantations covering an aggregate of about 1,000 acres, with about 570,000 full-grown plants. From the government plantations cinchona seeds and plants are annually distributed to the public in large quantities; and there are now several private plantations rivaling the government estates in area, and understood to be very valuable properties. The varieties of cinchona most commonly cultivated are *C. officinalis* and *C. succirubra*; but experiments are being conducted with *C. Calisaya*, *C. pubescens*, *C. lanceolata* and *C. pitayensis*. When the success of the enterprise was secure, government somewhat curtailed the extent of its own operations. No fresh land was taken up, but the plantations were kept free from weeds. The quinologist's department was abolished, and the bark sold in its raw state. From the central establishment on the Nilgiris, cinchona has been introduced into the Palni hills in Madura district, into the Wainád, and into the state of Travancore. Plantations have also been successfully opened by government near Merkara in Coorg, on the Bába Budan hills in Mysore, and in Sitang district in British Burmah. Failure has attended the experiments made at Mahábaleshwar in the Bombay presidency, and at Nongklao in the Khásí hills, Assam. But the success of the government plantation at Dárjiling, in northern Bengal, rivals that of the original plantation on the Nilgiris. The area has been gradually extended to more than 2,000 acres, and the bark is manufactured into quinine on the spot by a government quinologist. The species mostly grown is *C. succirubra*, which supplies a red colored bark, rich in its total yield of alkaloids, but comparatively poor in quinine proper. Efforts are being made to increase the cultivation of *C. Calisaya*, which yields the more valuable bark, but is difficult to propagate.

Sericulture in India is almost a stationary, if not a declining, industry. The large production in China, Japan, and the Mediterranean countries controls the European markets, and on an average of years the imports of raw silk into India now exceed the exports. The East India Company from the first took great pains to foster the production of silk. As early as 1767, two years after the grant of the financial administration of Bengal had been conferred upon the Company, we find the governor, Mr. Verelst, personally urging the *zamindárs*, gathered at Murshidábád for the ceremony of the

púnyá, "to give all possible encouragement to the cultivation of mulberry." In 1769 a colony of reelers was brought from Italy to teach the system followed in the filatures at Novi. The first silk prepared in the Italian method reached England in 1772, and Bengal silk soon became an important article of export. Similar efforts started at Madras in 1793 were abandoned after a trial of five years. Sericulture is said to have been introduced into Mysore by Tipú Sultán, and for many years continued to prosper. But recently the worms have been afflicted by a mysterious epidemic; and despite the enterprise of an Italian gentleman who imported fresh broods from Japan, the business has dwindled to insignificance. Bengal has always been the chief seat of mulberry cultivation. When the trading operations of the Company ceased in 1833, they owned eleven head factories in that province, each supplied by numerous filatures to which the cultivators brought in their cocoons. The annual export of raw silk from Calcutta was then about 1,000,000 pounds. But in those days the weaving of silk formed a large portion of the business of the factories. In 1779 Rennel wrote that at Kasimbázár (Cossimbazar) alone about 400,000 pounds were consumed in the several European factories. In 1802 Lord Valentia describes Jangipur as "the greatest silk station of the Company, with 600 furnaces, and giving employment to 3,000 persons."

When the Company abandoned trade on its own account, sericulture was forthwith taken up by private enterprise, and it still clings to its old headquarters. At the present time the cultivation of the mulberry is mainly confined to the Rájsháhí and Bardwán divisions of Lower Bengal. That branch of agriculture, together with the rearing of the silkworms, is conducted by the peasantry themselves, who are free to follow or abandon the business. The destination of the cocoons is twofold. They may either be sent to small native filatures, where the silk is roughly wound before being consumed in the hand-loom of the country; or they may be brought to the great European factories, which generally use steam machinery and consign their produce direct to Europe.

The cultivation of the mulberry is chiefly carried on in the districts of Rájsháhí, Bográ, Maldah, Murshidábád, Birbhúm, Bardwán and Midnapur. No accurate statistics are available, but in Rájsháhí alone the area under mulberry is estimated at 80,000 acres. The variety grown as food for the silkworms is not the fruit-tree that is common in England, but a comparatively small shrub.

Besides the silkworm proper (*Bombyx mori*), fed upon the mulberry, several other species of silk-yielding worms abound in the jungles of India, and are utilized, and in some cases domesticated, by the natives. Throughout Assam especially, an inferior silk, produced in this way, has from time immemorial furnished the common dress of the people. These "wild silks" are known to commerce under the generic name of *tasar* or *tusser*, but they are really the produce of several distinct varieties of worm, fed on many different trees. The worm that yields *tasar* silk in Chutiá Nágpur has been identified as the caterpillar of *Antheræa paphia*. When wild, it feeds indiscriminately upon the *sál* (*Shorea robusta*), *baer* (*Zizyphus Jujuba*), and other forest trees; but in a state of semi-domestication it is exclusively reared upon the *ásan* (*Terminalia alata*), which grows conveniently in clumps. The cocoons are sometimes collected in the jungle, but more frequently bred from an earlier generation of jungle cocoons. The worms require constant attention while feeding to protect them from crows and other birds. They give three crops in the year—in August, November, and May—of which the second is by far the most important. The

tasar silkworm is also found and utilized throughout the Central Provinces, in the hills of the Bombay presidency, and along the southern slope of the Himálayas. During the past twenty years repeated attempts have been made to raise this industry out of its precarious condition, and to introduce *tasar* silk into the European market. That the raw material abounds is certain, but the great difficulty is to obtain it in a state that will be acceptable to European manufacturers. Native spun silk is only fit for native hand-loom. In Assam two distinct qualities of silk are made, known as *criá* and *mugá*. The former is obtained from the cocoons of *Phalena cynthia*, and the worm is fed, as the native name implies, upon the leaves of the castor-oil plant (*Ricinus communis*). This variety may be said to be entirely domesticated, being reared indoors. *Mugá* silk is obtained from the cocoons of *Saturnia assamungis*. The moth, which is remarkable for its size, is found wild in the jungle, but the breed is so far domesticated that cocoons are brought from one part of the province to another, and the *súm* tree is artificially propagated to supply the worms with food.

The collection of lac is in a somewhat similar position to that of *tasar* silk. The lac insect abounds on certain jungle trees in every part of the country, and from time immemorial it has been collected by the wild tribes in order to be worked up into lacquered ware. European enterprise has tried, with small success, to place the industry upon a stable and remunerative basis. Though lac is to be found everywhere, the foreign exports are almost entirely confined to Calcutta, which draws its supplies from the hills of Chutiá Nágpur, and to a less degree from Assam and Mírzápur in the North-western Provinces. Lac is known to commerce both as a gum (shellac) and as a dye.

The efforts of government to improve the native methods of agriculture, by the establishment of model farms under skilled European supervision, have not been generally successful.

Throughout the whole of India, except in Sind and in the western districts of the Punjab, horned cattle are the only beasts used for plowing. The well-known humped breed of cattle predominates everywhere, being divided into many varieties. Owing partly to unfavorable conditions of climate and soil, partly to the insufficiency of grazing ground, and partly to the want of selection in breeding, the general condition of the cattle is miserably poor. As cultivation advances, the area of waste land available for grazing steadily diminishes, and the prospects of the poor beasts are becoming worse rather than better. Their only hope lies in the introduction of fodder crops as a regular stage in the agricultural course. There are, however, some fine breeds in existence. In Mysore the *amrit mahál*, a breed said to have been introduced by Hyder Ali for military purposes, is still kept up by government. In the Madras districts of Nellore and Karnúl the indigenous breed has been greatly improved under the stimulus of cattle shows and prizes, founded by British officials. In the Central Provinces there is a peculiar breed of trotting bullocks which is in great demand for wheeled carriages. The large and handsome oxen of Guzerat in Bombay and of Hariáná in the Punjab are excellently adapted for drawing heavy loads in a sandy soil. The worst cattle are to be found always in the deltaic tracts, but there their place is to a large extent taken by buffaloes. These last are more hardy than ordinary cattle; their character is maintained by crossing the cows with wild bulls, and their milk yields the best *ghí*, or clarified butter. In British Burmah, the returns show that the total number of buffaloes is just equal to that of cows and bullocks, being about 700,000.

Along the valley of the Indus, and in the sandy desert which stretches into Rájputána, camels supersede cattle for agricultural operations. In the Punjab, the total estimated number of camels is 170,000. The breed of horses has generally deteriorated since the demand for military purposes has declined with the establishment of British supremacy. In Bengal Proper, and also in Madras, it may be broadly said that horses are not bred. The chief breeds in Bombay are those of the Deccan and of Káthiáwár, in both of which provinces government maintains establishments of stallions. The Punjab, however, is the chief source of remounts for the cavalry regiments, the total number of horses in that province being returned at 80,000, in addition to 50,000 ponies. About the beginning of the present century, a stud department was organized to breed horses for the use of the Bengal army, but this system was abolished as extravagant and inefficient under the governor-generalship of Lord Mayo. Remounts are now obtained in the open market; but the government of the Punjab still maintains about 130 stallions, including sixty imported from England and forty Arabs. The best horses are bred by the Baluchí tribes along the western frontier. The best ponies come from Burmah, Manipur (the original home of the now well-known game of polo), and Bhután. Four great horse fairs are held in the year—at Ráwal Pindí, Derá Ghází Khán, Jhang and Derá Ismáíl Khán. In recent years much attention has been paid in the Punjab to the breeding of mules for military purposes; and the value of these animals was conspicuously proved in the course of the operations in Afghánistán in 1879-80. Government maintains about fifty donkey stallions, of which four were imported from Spain, twenty-eight from Arabia, and twelve from Bokhara. Some of the mules bred reach the height of fifteen hands. The catching of elephants is now a government monopoly or under government supervision, except in Malabar and Travancore, where the old proprietors retain the right. The chief source of supply is the northeast frontier, especially the range of hills running between the valleys of the Brahmaputra and the Bárak. Sheep and goats are commonly reared in the wilder parts of the country for the sake of their wool. Both their weight for the butcher and their yield of wool are exceedingly low. In Mysore, and with considerable success at the Saidapet farm, attempts have been made to improve the breed of sheep by crossing with merino rams. Pigs of great size and most repulsive appearance are reared, and eaten by the lowest of out-castes.

The forests of India, both as a source of natural wealth and as a department of the administration, are beginning to receive their proper share of attention. Up to a recent date the destruction of forests by timber cutters, by charcoal burners, and above all by nomadic cultivators, was allowed to go on everywhere unchecked. The extension of cultivation was considered as the chief care of government, and no regard was paid to the improvident waste going on on all sides. But as the pressure of population on the soil became more dense, and the construction of railways increased the demand for fuel, the question of forest conservation forced itself into notice. It was recognized that the inheritance of future generations was being recklessly sacrificed to satisfy the immoderate desire for profit. And at the same time the importance of forests as affecting the general meteorology of a country was being learned from bitter experience in Europe. On many grounds, therefore, it became necessary to preserve what remained of the forests in India, and to repair the mischief of previous neglect even at considerable expense. In 1844 and 1847 the subject was actively taken up by the governments of Bombay and Madras. In 1864 Doctor Brandis was

appointed inspector-general of forests to the government of India, and in the following year an act of the legislature was passed (No. VII. of 1865). The regular training of candidates for the Forest Department in the schools of France and Germany dates from 1867. In the short interval that has since elapsed, sound principles of forest administration have been gradually extended. Indiscriminate timber-cutting has been prohibited, the burning of the jungle by the hill tribes has been confined within bounds, large areas have been surveyed and demarcated, plantations have been laid out, and, generally, forest conservation has become a reality.

The practice of nomadic cultivation by the hill tribes may conveniently be described in connection with forest conservation, of which it is the most formidable enemy. In all the great virgin forests of India, in Arakan, on the northeast frontier of Assam and Chittagong, throughout the Central Provinces, and along the line of the Western Gháts, the aboriginal tribes raise their crops of rice, cotton, etc., in this manner. A similar system has been found to prevail in Madagascar; and indeed, from its simplicity and its appropriateness it may fairly be called the most primitive mode of agriculture known to the human race. Known as *toungya* in Burmah, *júm* on the northeast frontier, *dahya* in Central India, *kil* in the Himálayas, and *kumári* in the Western Gháts, it is practiced, without any material differences, by tribes of the most diverse origin. Its essential features are the burning down of a patch of forest, and sowing the crop with little or no tillage on the clearing thus formed. The tribes of the western coast break up the cleared soil with a sort of hoe-pick and spade or even with the plow; in other parts the soil is merely scratched with a knife, or the seed is scattered on its surface without any cultivation at all. In some cases a crop is taken off the same clearing for two or even three years in succession, but more usually the tribe moves off every year to a fresh field of operations. To these nomad cultivators the words rhetorically used by Tacitus of the primitive Germans are strictly applicable: *Arva per annos mutant; et superest ager*. The wanton destruction thus wrought in the forests is simply incalculable. In addition to the timber trees deliberately burned down to clear the soil, the fire thus started not infrequently runs wild through the forest, and devastates many square miles. Wherever timber has any value from the proximity of a market, the first care of the Forest Department is to prohibit these fires, and to assign heavy penalties for any infringement of its rules. The success of a year's operations is mainly estimated by the degree in which the reserves have been saved from the flame.

Irrigation is everywhere dependent upon the two supreme considerations of water supply and land level. The sandy desert that extends from the hills of Rájputána to the basin of the Indus is more absolutely closed to irrigation than the confused system of hill and valley in Central India. Farther west, in the Indus valley, irrigation becomes possible, and in no part of India has it been conducted with greater perseverance and success. The entire province of Sind, and hardly less the lower districts of the Punjab, are absolutely dependent upon the floods of the Indus. Sind has been compared to Egypt, and the Indus to the Nile; but, in truth, the case of the Indian province is the less favorable of the two. In Sind the average rainfall is barely ten inches in the year, the soil is a thirsty sand, and, above all, the river does not run in confined banks, but wanders at its will over a wide valley. The rising of the Nile is a beneficent phenomenon, whose effects can be calculated with tolerable precision, and which the

industry of countless generations has brought under control for the purposes of cultivation. In Sind the inundation is an uncontrolled torrent, which oftentimes does as much harm as good. Broadly speaking, no crop can be grown in Sind except under irrigation, and therefore the total cultivated area of about 3,000,000 acres may be regarded as entirely dependent upon artificial water-supply. The supply is derived from the river by two main classes of canals—(1) inundation channels, which only fill when the Indus is in flood, and (2) perennial channels, which carry off water by means of dams at all seasons of the year. The former are for the most part the work of ancient rulers of the country, or of the cultivators themselves; the latter have been constructed since the British conquest. In both cases care has been taken to utilize abandoned channels of the river. It is impossible to present a complete view of the results of irrigation, for in some provinces, as in Sind, it is treated as a department of land administration, while in others it is almost entirely conducted by private enterprise.

COMMERCE.

The trade of India may be considered under four heads:—(1) sea-borne trade with foreign countries; (2) coasting trade; (3) frontier trade, chiefly across the northern mountains; (4) internal traffic within the limits of the empire.

With an extensive seaboard, India has but very few ports. Calcutta monopolizes the commerce, not only of Lower Bengal, but of the entire basins of the Ganges and the Brahmaputra. Bombay is the sole outlet for the agricultural wealth of Guzerat, the Decan, and the Central Provinces; while Karáchi (Kurachee) performs a similar office for the Indus, and Rangoon for the Irawadi. The natural value of these four ports has been permanently confirmed by the construction of the main lines of railway communication. In the south of India only is sea-borne trade distributed along the coast. The western side has a succession of tolerable harbors, from Goa to Cochin. On the east there is not a single safe roadstead nor a navigable river, but ships anchor some distance off the shore at Madras, and at other points, generally near the mouths of the rivers. Of the total foreign trade of India, Calcutta and Bombay control about 40 per cent. each; Madras has 6 per cent., Rangoon 4 per cent., and Karáchi 2 per cent., leaving a balance of only 8 per cent. for all the remaining ports of the country. Calcutta and Bombay may be called the two centers of collection and distribution, to a degree without a parallel in other countries; and the growth of their prosperity is identical with the development of Indian commerce.

As regards the imports, the first thing to notice is the enormous predominance of two items—cotton goods and treasure. On an average of the last forty years, cotton goods form 33 per cent., or exactly one-third of the total, and treasure an additional 30 per cent. Next in order come metals (copper, which is largely used by native smiths, slightly exceeding iron, government stores, including munitions of war, boots, liquor, and clothing for soldiers, and railway plant; liquors, entirely for European consumption; coal for the use of the railways and mills; railway plant for the guaranteed companies; provisions, machinery and mill-work, and manufactured silk. It will thus be seen that, with the single exception of Manchester goods, no articles of European manufacture are in demand for native consumption, but only for the needs of the civilized administration, and no raw produce, except copper, iron, and salt.

Considering that England's export trade with India thus mainly depends upon piece-goods, it is curious to

recollect the history of cotton manufacture. In the beginning of the seventeenth century the industry had not been introduced into England, and whatever demand there was for cotton in that country was satisfied by circuitous importations from India itself, where cotton-weaving is an immemorial industry. In 1641 "Manchester cottons," in imitation of Indian calicoes and chintzes, were still made of wool. Cotton is said to have been first manufactured in England in 1676. To foster the nascent industry, a succession of statutes were passed prohibiting the wearing of imported cottons; and it was not until after the inventions of Arkwright and others and the application of steam as a motive power had secured to Manchester the advantage of cheap production that these protective measures were entirely removed. In the present century Lancashire has rapidly distanced her instructors. During the five years 1840-45 the annual import of cotton manufactures into India averaged a little over £3,000,000 sterling. In each subsequent quinquennial period there has been a steady increase.

The importation of treasure is perhaps still more extraordinary, when we bear in mind that it is not consumed in the using, but remains permanently in the country. During the same period of forty years the net import of treasure, deducting export, has reached the enormous aggregate of just £319,000,000 sterling, or more than £1, 6s. 6d. per head of the 240,000,000 inhabitants of the peninsula. Of course, by far the larger portion of this was silver, but the figures for gold are by no means inconsiderable. On separating the reexports from the imports, the attraction of gold to India appears yet more marked. Of the total imports of gold only 7 per cent. was reexported, while for silver the corresponding proportion was 19 per cent. Roughly speaking, it may be concluded that India then absorbed about £3,000,000 sterling of gold a year. The supply is drawn chiefly from China, Ceylon, Great Britain, and Australia. The depreciation of silver that has since taken place has caused an enormous increase in the import of silver and a corresponding increase in the export of gold. The figures since 1876 do not show the normal state of things. But even in 1877-78, when the value of silver was at its lowest, though India drew upon its hoards of gold for export to the amount of more than £1,000,000 sterling, it yet imported more than £1,500,000, showing a net import of half a million of gold. It has been estimated that the gold circulation of India amounts to about 1,620,000 gold *mohars*, as compared with £158,000,000 of silver and £2,960,000 of copper. In addition, 10,000,000 sovereigns are said to be hoarded in India, mainly in the Bombay presidency, where the impression of St. George and the Dragon is valued on religious grounds.

The export of raw cotton has been subject to excessive variations. At the close of the last century cotton was sent to England in small quantities, chiefly the produce of the Central Provinces, collected at Mírzápúr and shipped at Calcutta, or the produce of Guzerat, dispatched from Surat. In the year 1805 the total export of cotton from Surat was valued at £108,000; in the same year the English returns show only 2,000 bales of East Indian cotton imported into Great Britain. But this figure was far below the average, for by 1810 the corresponding number of bales had risen to 79,000, to sink again to 2,000 in 1813, and to rise to 248,000 in 1818. Bombay did not begin to participate in this trade until 1825, but has now acquired the practical monopoly, since the railway has diverted to the west the produce of the Central Provinces. In 1834, when the commerce of India was first thrown open, 33,000,000 pounds were exported. Analyzing the exports of cotton during the

forty years since 1840, we find that in the first quinquennial period they averaged two and one-third millions sterling in value, and did not rise perceptibly until 1858, when they first touched £4,000,000. From that date the increase was steady, even before the American exports were cut off by war in 1861. India then made the most of her opportunity, though quantity and quality did not keep pace with the augmented price. The highest figures of value were attained with £37,500,000 sterling in 1865, and the highest figure of quantity with 803,000,000 pounds in 1866. Thenceforth the decline has been constant, though somewhat irregular, the lowest figures both of quantity and value being those of 1878-79. The most recent feature of the trade is the comparatively small amount shipped to the United Kingdom, and the even distribution of the rest among Continental ports.

Second in importance to cotton as a raw material of British manufacture comes jute, the trade in which is a creation of less than thirty years. At the time of the London Exhibition of 1851 jute fiber was practically untried and unknown, while attention was even then actively drawn to rhea or China grass, which remains to the present day unmanageable by any cheap process. From time immemorial jute has been grown in the swamps of Eastern Bengal, and has been woven into coarse fabrics for bags and even clothing. As early as 1795 Doctor Roxburgh called attention to the commercial value of the plant, which he grew in the Botanical Gardens of Calcutta and named "jute," after the language of his Orissa gardeners, the Bengali word being *pát* or *koshta*. In 1828-29 the total exports of jute were only 364 hundredweights, valued at £62. From that date the trade steadily grew, until in the quinquennial period ending 1847-48 the exports averaged 234,055 hundredweights. The Crimean war, which cut off the supplies of Russian flax and hemp from the Forfarshire weavers, made the reputation of jute.

The export of grain, as already noticed, is now in the aggregate larger than that of cotton. The two chief items are rice and wheat. Rice is exported from British Burmah, from Bengal, and from Madras. From the point of view of the English produce market rice means only Burmese rice, which is annually exported to the large amount of about 12,000,000 hundredweights, valued at £3,000,000. In the Indian tables this is all entered as consigned to the United Kingdom, though, as a matter of fact, the rice fleets from Burmah only call for orders at Falmouth, and are thence diverted to various English or Continental ports. India has a practical monopoly of the European market. An export duty is levied on rice in India at the rate of three *ánnds* per *maund*, or about 6d. per hundredweight. A similar duty on wheat was repealed in 1875, and that trade has since conspicuously advanced. In 1874-75 the export of wheat was about 1,000,000 hundredweights. Forthwith it increased year by year, until it exceeded 6,250,000 hundredweights, valued at nearly £3,000,000. In 1879 the quantity fell away to almost nothing, owing to the general failure of the harvest in the producing districts. The Punjab is the principal wheat-growing tract in India, but hitherto the chief supplies have come from the Northwestern Provinces and Oudh, being collected at Cawnpur and thence dispatched by rail to Calcutta.

Oil-seeds, also, were freed in 1875, the duty previous to that date having been 3 per cent. *ad valorem*. Ten years before, the average export was only about 4,000,000 hundredweights a year; but the fiscal change, coinciding with an augmented demand in Europe, has caused an increase of threefold. Linseed and rape are consigned mainly to the United Kingdom, while France takes almost the entire quantity of *tíl* or gingelly.

In actual amount, though not in relative importance, indigo holds its own in the face of competition from aniline dyes. The most noticeable feature in this trade is the diminishing proportion sent direct to England, and the wide distribution of the remainder. Of other dyes, safflower has greatly fallen off, being now only in demand for a rouge in China and Japan. The export of myrobalans, on the other hand, was greatly stimulated by the Russo-Turkish war, which interrupted the supply of valonia and galls from Asia Minor. Practically the whole is sent to the United Kingdom. Turmeric, also, exhibits an increase. Lac-dye, like other kinds of lac, shows a depressed trade.

No other export has made such steady progress as tea, which has multiplied more than fourfold in the space of ten years. Indian tea has now a recognized position in the London market, generally averaging about 4d. per pound higher in value than Chinese tea, but it has failed to win acceptance in most other countries, excepting Australia. The exports of coffee from India are stationary, if not declining.

Of manufactured goods, cotton and jute deserve notice, though by far the greater part of the produce of the Indian mills is consumed locally. Piece-goods belong to two classes. Colored goods, woven in hand-loom, are exported from Madras to Ceylon and the Straits, to the annual value of about £230,000.

Jute manufactures consist of gunny bags, gunny cloths, and rope and twine, almost entirely the produce of the Calcutta mills. In all of these the value of the exports is increasing faster than the quantity, having multiplied nearly fourfold in the last five years.

In any community raised above primitive barbarism the aggregate volume of its internal trade must be far greater than that of its foreign commerce; but, from the nature of the case, it is impossible to estimate its amount or even to describe adequately its general character. On the one hand, there is the wholesale business connected with foreign commerce in its earliest stages—the collection of agricultural produce from a thousand little villages, its accumulation at a few great central marts, and its despatch to the seaboard, in return for which manufactured articles are distributed by the same channels, though in the reverse direction. On the other hand, there is the interchange of commodities of native growth and manufacture, sometimes between neighbors, but also between distant provinces. With a few unimportant exceptions, free trade is the rule throughout the vast peninsula of India, by land as well as by sea. The Hindus possess a natural genius for commerce, as is shown by the daring with which they have penetrated into the heart of Central Asia, and to the east coast of Africa. Among the benefits which British rule has conferred upon them is the removal of the innumerable shackles that a shortsighted despotism had imposed upon their talents.

Broadly speaking, the greater part of the internal trade remains in the hands of the natives. Europeans control the shipping business, and have a share in the collection of some of the more valuable staples of exports, such as cotton, jute, oil-seeds, and wheat. But the work of distribution and the adaptation of the supply to the demand of the consumer naturally fall to those who are best acquainted with native wants. Even in the presidency towns the retail shops are generally owned by natives. The Vaisya, or trading caste of Manu, has no longer any separate existence; but its place is occupied by several well-marked classes. On the western coast the Pársis, by the boldness and extent of their operations, tread close upon the heels of the most prosperous English houses. In the interior of the Bombay presidency, business is mainly divided between two

classes, the Baniyas of Guzerat and the Márwáris from Rájputána. Each of these profess a peculiar form of religion, the former being Vishnuvites of the Vallabháchári sect, the latter Jains. In the Deccan their place is taken by Lingáyats from the south, who again follow their own form of Hinduism, which is an heretical species of Siva worship. Throughout Mysore, and in the north of Madras, Lingáyats are still found, but along the eastern seaboard the predominating classes of traders are those named Chetties and Komatis. In Bengal many of the upper castes of Súdras have devoted themselves to general trade; but there again the Jain Márwáris from Rájputána and the Northwest occupy the front rank. Their headquarters are in Murshidábád district, and their agents are to be found throughout the valley of the Brahmaputra, as far up as the unexplored frontier of China. They penetrate everywhere among the wild tribes; and it is said that the natives of the Khásí hills are the only hillmen who do their own business of buying and selling. In the Northwestern Provinces and Oudh the traders are generically called Baniyas; and in the Punjab are found the Khatrís, who have perhaps the best title of any to regard themselves as descendants of the original Vaisyas. According to the general census of 1872, the total number of persons in all India returned as connected with commerce and trade was 3,224,000, or 5.2 per cent. of the adult males.

Local trade is conducted either at the permanent *bázárs* of great towns, at weekly markets held in certain villages, at annual gatherings primarily held for religious purposes, or by means of traveling brokers and agents. The cultivator himself, who is the chief producer and also the chief customer, knows little of the great towns, and expects the dealer to come to his own door. Each village has at least one resident trader, who usually combines in his own person the functions of money-lender, grain-dealer and cloth-seller. The simple system of rural economy is entirely based upon the dealings of this man, whom it is the fashion sometimes to decry as a usurer, but who is really the one thrifty person among an improvident population. Abolish the money-lender, and the general body of cultivators would have nothing to depend upon but the harvest of a single year. The money-lender deals chiefly in grain and in specie. In those districts where the staples of export are largely grown, the cultivators commonly sell their crops to traveling brokers, who re-sell to larger dealers, and so on until the commodities reach the hands of the agents of the great shipping houses. The wholesale trade thus rests ultimately with a comparatively small number of persons, who have agencies, or rather corresponding firms, at the great central marts. Buying and selling in their aspects most characteristic of India are to be seen, not at these great towns, nor even at the weekly markets, but at the fairs which are held periodically at certain spots in most districts. Religion is always the original pretext of these gatherings or *melás*, at some of which nothing is done beyond bathing in the river, or performing various superstitious ceremonies. But in the majority of cases, religion has become a mere excuse for secular business. Crowds of petty traders attend, bringing all those miscellaneous articles that can be packed into a peddler's wallet; and the neighboring villagers look forward to the occasion to satisfy alike their curiosity and their household wants.

MANUFACTURES.

Though India may be truly described as an agricultural and not a manufacturing country, yet it would be erroneous to infer that it is destitute of the arts of civilized life. It has no swarming hives of industry to compare with the factory centers of Lan-

cashire, nor a large mining population, living under the soil rather than on it. In short, it has not reached that modern stage of industrial development which is based upon the use of coal and the discoveries of physical science. But in all manufactures requiring manual dexterity and artistic taste India may challenge comparison with England in the last century. The organization of Hindu society demands that the necessary arts, such as those of the weaver, the potter, and the smith, should be practiced in every village. The pride and display of the rival kingdoms, into which the country was formerly divided, gave birth to many arts of luxury that have not yet been entirely forgotten in the decayed capitals. When the first European traders reached the coast of India in the sixteenth century, they found a civilization among both "Moors" and "Gentooes" at least as highly advanced as their own. In architecture, in fabrics of cotton and silk, in goldsmith's work and jewelry, the people of India were then unsurpassed. But while the East has stood still, or rather retrograded (for, in the face of keen competition, to stand still is to retrograde), the West has advanced with a gigantic stride which has no parallel in the history of human progress. On the one hand, the downfall of the native courts has deprived the skilled workman of his chief market, while, on the other, the English capitalist has enlisted in his service forces of nature against which the village artisans in vain try to compete. The fortunes of India are bound up with those of a country whose manufacturing supremacy depends upon a great export trade. The tide of circumstances, more inexorable than artificial enactments, has compelled the weaver to exchange his loom for the plow, and has crushed out a multitude of minor handicrafts. Political economy, judging only by the single test of cheapness, may approve the result; but the philosopher will regret the increasing uniformity of social conditions, and the loss to the world of artistic tendencies which can never be restored.

Historically the most interesting, and still the most important in the aggregate, of all Indian industries are those conducted in every rural village of the land. The Hindu village system is based upon division of labor quite as much as upon hereditary caste. The weaver, the potter, the blacksmith, the brazier, the oil-presser, are each members of the community, as well as inheritors of a family occupation. On the one hand, they have a secure market for their wares, and, on the other, their employers have a guarantee that their trades shall be well learned. Simplicity of life and permanence of employment are here happily combined with a high degree of excellence in design and honesty of execution. The stage of civilization below these village industries is represented by the hill tribes, especially those on the northeast frontier, where the weaving of clothes is done by the women of the family—a practice which also prevails throughout Burmah. A higher stage may be found in those villages or towns which possess a little colony of weavers or braziers noted for some specialty. Yet one degree higher is the case of certain arts of luxury, such as ivory carving or the making of gold lace, which chance or royal patronage has fixed at some capital now perhaps falling into decay. One other form of native industry owes its origin to European interference. Many a village in Lower Bengal and on the Coromandel coast still shows traces of the time when the East India Company and its European rivals gathered large settlements of weavers around their little forts, and thus formed the only industrial towns that ever existed in India. But when the Company abandoned its manufacturing business in 1833, these centers of industry rapidly declined; and the once

celebrated muslins of India have been driven out of the market of the world by Manchester goods.

Cotton weaving may be called the oldest indigenous industry of India. The Greek name for cotton fabrics, *sindon* (σινδών), is etymologically the same as that of India or Sind; in later days Calicut on the Malabar coast has given us "Calico." Cotton cloth, whether plain or ornamented, has always been the single material of clothing for both men and women, except in Assam and Burmah, where silk is preferred, perhaps in reminiscence of an extinct trade with China. When European adventurers found the way to India, cotton and silk always formed part of the rich cargoes they brought home. The English, in especial, appear to have been careful to fix their earliest settlements amid a weaving population—at Surat, at Calicut, at Masulipatam, at Hooghly. In delicacy of texture, in purity and fastness of color, in grace of design, Indian cottons may still hold their own against the world; but in the matter of cheapness they have been unable to face the competition of Manchester.

Silk weaving is also a common industry everywhere, silk fabrics, or at least an admixture of silk in cotton, being universally affected as a mark of wealth. Throughout British Burmah, and also in Assam, silk is the common material of clothing, being made up by the women of the household. In Burmah, the bulk of the silk is imported from China, generally in a raw state; but in Assam it is obtained from two or three varieties of worms, which are generally fed on jungle trees, and may be regarded as semi-domesticated. Bengal is the only part of India where sericulture, or the rearing of the silkworm proper on mulberry, can be said to flourish. The greater part of the silk is wound in European filatures, and exported in the raw state to Europe. The native supply is either locally consumed, or sent up the Ganges to the great cities of the northwest. A considerable quantity of raw silk, especially for Bombay consumption, is imported from China. *Tasar* silk, or that obtained from the cocoons of semi-domesticated worms, does not contribute much to the supply. As compared with cotton weaving, the manufacture of silk fabrics may be called a town and not a village industry. These fabrics are of two kinds—(1) those composed of pure silk, and (2) those with a cotton warp crossed by a woof of silk. Both kinds are often embroidered with gold and silver. The mixed fabrics are known as *mashru* or *sufi*, the latter word meaning "permitted," being used because the strict ceremonial law will not allow Mahometans to wear clothing of pure silk. They are largely woven in the towns of the Punjab and Sind, at Agra, at Hyderabad in the Deccan, and at Tanjore and Trichinopoly. Pure silk fabrics are either of simple texture, or highly ornamented in the form of *kinkhabs* or brocades. The latter are a specialty of Benares, Murshidábád, Ahmadábád, and Trichinopoly. Printed silks are woven at Surat for the wear of Pársi and Guzerati women. Quite recently mills with steam machinery have been established at Bombay, which weave silk fabrics for the Burmese market, chiefly *lúngyís*, *tamains*, and *patsoes*. The silk manufactures exported from India consist almost entirely of the handkerchiefs known as *bandannas* and *corahs*, with a small proportion of *tasar* fabrics.

Embroidery has already been referred to in the two preceding paragraphs. The groundwork may be either silk, cotton, wool, or leather. The ornament is woven in the loom, or sewn on afterward with the needle. Muslin is embroidered with silk and gold thread at Dacca, Patná, and Delhi. Sind and Cutch (Kachh) have special embroideries of colored silk and gold. Leather-work is embroidered in Guzerat. In some of

the historical capitals of the Deccan, such as Gulbargah and Aurangábád, velvet (*makhmal*) is gorgeously embroidered with gold, to make canopies, umbrellas, and housings for elephants and horses, for use on state occasions. Not only the goldsmith, but also the jeweler lends his aid to Indian embroidery.

Carpets and rugs may be classified into those made of cotton and those made of wool. The former, called *satranjis* and *daris*, are made chiefly in Bengal and northern India, and appear to be an indigenous manufacture. The woolen or pile carpets known as *kalin* and *kalicha* are those which have recently attained so much popularity in England, by reason of the low price at which the out-turn of the jail manufactories can be placed in the market. The art was probably introduced into India by the Mahometans. The historical seats of the industry are in Kashmír, the Punjab, and Sind, and at Agra, Mírzápur, Jabalpur, Warangal in the Deccan, Malabar, and Masulipatam. Velvet carpets are also made at Benares and Murshidábád, and silk pile carpets at Tanjore and Salem.

Gold and silver and jewels, both from their color and their intrinsic value, have always been the favorite material of Oriental ornament. Even the hill tribes of Central India and the Himálayas have developed some skill in hammering silver into brooches and torques. Imitation of knotted grass and leaves seems to be the origin of the simplest and most common form of gold ornament, the early specimens consisting of thick gold wire twisted into bracelets, etc. A second archaic type of decoration is to be found in the chopped-gold jewelry of Guzerat. That is made of gold lumps, either solid or hollow, in the form of cubes and octahedrons, strung together on red silk. Of artistic jeweler's work, the best known examples come from Trichinopoli, Cuttack, Delhi, and Kashmír. Throughout southern India the favorite design is that known as *swámi*, in which the ornamentation consists of figures of Hindu gods in high relief, either beaten out from the surface or fixed upon it by solder or screws. The hammered *repoussé* silver work of Cutch (Kachhch), though now entirely naturalized, is said to be of Dutch origin. Similar work is done at Lucknow and Dacca. The goldsmith's art contributes largely to embroidery, as has already been mentioned. Gold and silver thread is made by being drawn out under the application of heat. The operation is performed with such nicety that one rupee's worth of silver will make a thread nearly 800 yards long. Before being used in the loom this metallic thread is generally twisted with silk.

Precious stones are lavishly used by Indian jewelers, who care less for their purity and commercial value than for the general effect produced by a blaze of splendor. "But nothing can exceed the skill, artistic feeling, and effectiveness with which gems are used in India both in jewelry proper and in the jeweled decoration of arms and jade" (Birdwood).

The chief duty of the village smith is, of course, to make the agricultural implements for his fellow-villagers. But in many towns in India, often the sites of former capitals, iron-work, especially in the manufacture of arms, still retains a high degree of artistic excellence.

The blade of the Indian *talwár* or sword is sometimes marvelously watered, and engraved with date and name, sometimes sculptured in half-relief with hunting scenes, sometimes shaped along the edge with teeth or notches like a saw. Matchlocks and other firearms are made at several towns in the Punjab and Sind, at Monghyr in Bengal, and at Vizianágaram in Madras. Chain armor, fine as lacework and said to be of Persian origin, is still manufactured in Kashmír. Rájputána, and

Cutch (Kachhch). Ahmadnagar in Bombay is famous for its spearheads. Both firearms and swords are often damascened in gold, and covered with precious stones. In fact, the characteristic of Indian arms, as opposed to those of other Oriental countries, is the elaborate gold-work hammered or cut upon them and the unsparing use of gems. Damascening on iron and steel, known as *kufi*, is chiefly practiced in Kashmír, and at Guzerat and Siálkot in the Punjab. Damascening in silver, which is chiefly done upon bronze, is known as *bidari* work, from the ruined capital of Bidar in the nizam's dominions, where it is still chiefly carried on.

The village brazier manufactures the necessary vessels for domestic use. Chief among these is the *lota*, or globular bowl, universally used in ceremonial ablutions. The form of the *lota*, and even the style of ornamentation, has been handed down unaltered from the earliest times. Benares enjoys the first reputation in India for work in brass and copper. In the south, Madura and Tanjore have a similar fame; and in the west, Ahmadábád, Poona, and Násik. At Bombay itself large quantities of imported copper are wrought up by native braziers. The temple bells of India are well known for the depth and purity of their note. In many localities the braziers have a special repute either for a peculiar alloy or for a particular process of ornamentation. Silver is sometimes mixed with the brass, and in rarer cases gold. The brass or rather bell-metal ware of Murshidábád, known as *khágrái*, has more than a local reputation, owing to the large admixture of silver in it.

Pottery is made in almost every village, from the small vessels required in cooking to the large jars used for storing grain, and occasionally as floats to ferry persons across a swollen stream. But, though the industry is universal, it has hardly anywhere risen to the dignity of a fine art. Sind is the only province in India where the potter's craft is pursued with any regard to artistic considerations, and there the industry is said to have been introduced by the Mahometans. Sind pottery is of two kinds, encaustic tiles and vessels for domestic use. In both cases the colors are the same—turquoise blue, copper green, dark purple, or golden brown, under an exquisitely transparent glaze. The usual ornament is a conventional flower pattern, pricked in from paper and dusted along the pricking. The tiles, which are evidently of the same origin as those of Persia and Turkey, are chiefly to be found in the ruined mosques and tombs of the old Musalmán dynasties; but the industry still survives at the little towns of Saidpur and Bubri. Artistic pottery is made at Hyderabad, Karáchi, Tatta, and Hála, and also across the border, at Lahore and Múltán in the Punjab. The Madura pottery also deserves mention from the elegance of its form and the richness of its color. The Northwestern Provinces have, among other specialties, an elegant black ware with designs in white metal worked into its surface.

Stone sculpture is an art of the highest antiquity in India, as may be seen in some of the early memorials of Buddhism. Borrowing an impulse from their Greek exemplars, the Buddhist sculptors at the commencement of our era freed themselves from the Oriental tradition which demands only the gigantic and the grotesque, and imitated nature with some success. But with the revival of Bráhmaism Hindu sculptors again degenerated; and so far as the art can still be said to exist, it possesses a religious rather than an æsthetic interest. In the cities of Guzerat, and in other parts of India where the houses are built of wood, their fronts are ornamented with elaborate carving. Wood-carving, an important industry in Western India, is said, perhaps erroneously, to owe its origin to Dutch patronage,

though the models of the carvers are evidently taken from their own temples. The favorite materials are blackwood, sandalwood, and jackwood. The supply of sandalwood comes from the forests of the Western Gháts in Kánara and Mysore, but some of the finest carving is done at Surat and Ahmadábád. Akin to sandalwood carving is the inlaying of the miscellaneous articles known as "Bombay boxes." This art is known to be of modern date, having been introduced from Shiraz in Persia toward the close of the last century. It consists of binding together in geometrical patterns strips of tin wire, sandalwood, ebony, ivory and stag's horn. At Vizagapatam, in Madras, similar articles are made of ivory and stag's horn, with scrollwork edged in to suit European taste. At Máinpuri, in the North-western Provinces, wooden boxes are inlaid with brass wire. The chief seats of ivory-carving are Amritsar, Benares, Murshidábád, and Travancore, where any article can be obtained to order, from a full-sized palanquin to a lady's comb. Human figures in clay, dressed to the life, are principally made at Krishnagar in Bengal, Lucknow, and Poona.

It remains to give some account of those manufactures proper, conducted by steam machinery and under European supervision, which have rapidly sprung up in certain parts of India during the past few years. These comprise cotton, jute, silk, and beer.

The first mill for the manufacture of cotton yarn and cloth by machinery worked by steam was opened at Bombay in 1854. Like the jute mills of Bengal, the cotton factories of Bombay have suffered of late years from the general depression of trade.

The jute mills of Bengal have sprung up to rival Dundee, just as Bombay competes with Manchester; but in the former case the capital is mostly supplied by Europeans. They cluster thickly around Calcutta, extending across the river into Hooghly district; and one has been planted at Sirájganj, far away up the Brahmaputra in the middle of the jute-producing country.

Brewing has recently become established as a prosperous business at the large hill stations on the Himálayas.

The steam paper-mills established in the neighborhood of Calcutta and at Bombay have almost entirely destroyed the local manufactures of paper which once existed in many parts of the country. The hand-made article, which was strong though coarse, and formed a Mahometan specialty, is now no longer used for official purposes. Besides manufacturing munitions of war, the government possesses a large leather factory at Cawnpur, which turns out saddlery, etc., of excellent quality. Indeed, leather manufactures are an important local industry in Oudh and the Northwestern Provinces, and are conducted on such a scale as to preclude the import from England, except in the case of *articles de luxe*.

MINERALS.

The Indian peninsula, with its wide area and diversified features, supplies a great store of mineral wealth, characterized both by variety and unusual richness. In utilizing this wealth, English enterprise has met with many rebuffs. Much capital has been expended with no other result in many cases than disappointment. But the experience has not been thrown away; and the mining industry, now established on a sure basis, is rising into an important position in a country which ought gladly to welcome any employment other than the universal pursuit of agriculture.

In the purity of ore, and in the antiquity of working, the iron deposits of India probably rank first in the world. They are to be found in every part of the

country, from the northern mountains of Assam and Kumáun to the extreme south of the Madras presidency. Wherever there are hills, iron is found and worked to a greater or less extent.

Coal has been known to exist in India since 1774, and is said to have been worked as far back as 1775. There are now altogether fifty eight collieries in the country, with an annual out-turn of about one million tons.

Salt, an article of supreme necessity to the Indian peasant, who eats no meat, is derived from three main sources, exclusive of importation from Europe:—(1) by evaporation from sea-water along the entire double line of seaboard from Bombay to Orissa, but especially in Guzerat and on the Coromandel coast; (2) by evaporation from inland lakes, of which the Sámbar Lake in Rájputána affords the chief example; (3) by quarrying solid hills of salt in the northeast of the Punjab. The last is the only case in which salt can be said to exist as a mineral. It occurs in solid cliffs, which for extent and purity are stated to have no rival elsewhere in the world.

At one time India had almost a monopoly of the supply of saltpeter upon which Europe then depended for its gunpowder. In combination with other saline substances it occurs as a white efflorescence upon the surface of the soil in many parts of the country, especially in the upper valley of the Ganges. Its preparation leaves common salt as one of the residuary products; and consequently fiscal reasons have tended to limit the manufacture to the most remunerative region, which is found in North Behar.

Gold exists in many parts and probably in considerable quantities. Herodotus affirms that the Indians were the only nation who paid their tribute to Darius in gold; and there is some reason for believing that the "Ophir" of King Solomon is to be identified with the Malabar coast. Nearly every hill stream is washed for gold, whether in the extreme south, in the central plateau, or on the northeast and northwest frontiers. It is true that gold-washing is everywhere a miserable business, affording the barest livelihood; but yet the total amount of gold obtained in this way cannot be insignificant. In recent years attention has been prominently drawn to the possibility of extracting gold from the quartz formation of southern India, which bears many points of resemblance to the auriferous quartz reefs of Australia. The principal localities are in the Wainád (Wynaad) subdivision of the Nílgi district and in Kolár district of Mysore. Gold-washing has always been practiced there; and the remains of old workings show that at some unknown period operations have been conducted on a large scale.

Copper is known to exist in many parts of the country in considerable quantities. The richest mines are in the lower ranges of the Himálayas, from Dárjiling westward to Kumáun. The ore occurs in the form of copper pyrites, often accompanied by mundic, not in true lodes, but disseminated through the slate and schist.

Lead occurs in the form of sulphuret or galena along the Himálayas on the Punjab frontier, and has been worked at one place by an English company.

Tin is confined to the Burmese peninsula. Very rich deposits, yielding about 70 per cent. of metal, occur over a large extent of country in Mergui and Tavoy districts of the Tenasserim region. The ore is washed and smelted, usually by Chinese, in a very rough and unscientific way. Recent experiments made by a European firm seem to show that the deposits, though rich and extensive, are not sufficiently deep to repay more elaborate processes.

Antimony, in the form of *surma*, which is largely used by the natives as a cosmetic, is chiefly derived from the

hill states of the Punjab. It is also found in Mysore and Burmah. The minerals of Rájputána, which have not yet been thoroughly ascertained, include an ore of cobalt used for coloring enamel.

Petroleum is produced chiefly in Independent Burmah, but it has also been found on British territory in Pegu, in Assam, and in the Punjab.

The commonest and also the most useful kind of stone of India is *kankar*, a nodular form of impure lime, which is found in almost every river valley, and is used universally for metaling the roads. Lime for building is derived from two sources—(1) from burning limestone and *kankar*, and (2) from the little shells so abundantly found in the marshes. Calcutta derives its chief supply from the quarries of the Khásí hills in Assam, known as "Sylhet lime," and from the Susunia quarries in Bankura district. The Gangetic delta is destitute of stone, nor does the alluvial soil afford good materials for brick-making or pottery. But a European firm has recently established large pottery-works at Rániganj in Bardwán, which employ about five hundred hands, and carry out contracts for drainage pipes and stoneware. The center of the peninsula and the hill country generally abound in building-stone of excellent quality, which has been used locally from time immemorial. Among the finest stones may be mentioned the pink marble of Rájputána, of which the historical buildings at Agra were constructed, the trap of the Deccan, the sandstone of the Godávári and the Narbadá, and the granite of southern India. Quarries of slate are scattered through the peninsula, and are sometimes worked by European capital. Mica and talc are also quarried to make ornaments. Among the hills of Orissa and Chutiá Nágpur household vessels and ornaments are skillfully carved out of an indurated variety of potstone.

Notwithstanding its legendary wealth, which is really due to the accumulations of many ages, India cannot be said to be naturally rich in precious stones. Under the Mahometan rule diamonds were a distinct source of state revenue; and Akbar is said to have received a royalty of £80,000 a year from the mines of Panna. But at the present day the search for them, if carried on anywhere in British territory, is an insignificant occupation. At the present day the only place where the search for diamonds is pursued as a regular industry is the native state of Panna (Punnah) in Bundelkhand. The stones are found by digging down through several strata of gravelly soil and washing the earth. Even there, however, the pursuit is understood to be unremunerative, and has failed to attract European capital. About other gems little information is available.

ADMINISTRATION.

The supreme authority over all British India, both for executive and legislative purposes, is vested by a series of acts of Parliament in the viceroy or governor-general-in-council, subject to the ultimate sanction of the secretary of state in England. Every executive order and every legislative statute runs in the name of the "Governor-General-in-Council;" but in certain exceptional classes of cases a power is reserved to the viceroy to act independently of his council. This council is twofold. First, there is the ordinary or executive council, usually composed of about six official members besides the viceroy, which may be compared with the cabinet of a constitutional country. It meets regularly at short intervals, discusses and decides upon questions of foreign policy and domestic administration, and prepares measures for the legislative council. Its members divide among themselves the chief departments of state, such as those of foreign affairs, finance, war, public works, etc.; while the viceroy combines in his

own person the duties both of constitutional sovereign and prime minister. Secondly, there is the legislative council, which is constituted by the same members as the preceding, with the addition of the governor of the province in which it may be held, and official delegates from Madras and Bombay, together with certain nominated members representing the non-official native and European communities. The meetings of the legislative council are held when and as required. They are open to the public; and a further guarantee for publicity is insured by the proviso that draft bills must be published a certain number of times in the *Gazette*. As a matter of practice, these draft bills have usually been first subjected to the criticism of the several provincial governments. In regard to the supreme judicial authority there is no such uniform system. The presidencies of Madras and Bombay, and also two of the three great provinces which have been created out of the old presidency of Bengal, and are now known as the lieutenant-governorships of Bengal and the Northwestern Provinces, have each a high court, supreme both in civil and criminal business, with an ultimate appeal to the judicial committee of the privy council in England. Of the subordinate provinces, the Punjab has a chief court, with three judges; the Central Provinces, Oudh, and Berar have each a judicial commissioner, who sits alone; while in Assam and British Burmah the chief commissioner, or supreme executive officer, is also the highest judicial authority.

The law administered in the Indian courts consists mainly of (1) the enactments of the Indian legislative councils above described and of the bodies which preceded them; (2) statutes of the British parliament which apply to India; (3) the Hindu and Mahometan laws on domestic inheritance or other cases affecting the Hindus and Mahometans, and (4) the customary law affecting particular castes and races. Much has been done toward consolidating individual sections of the Indian law; and in the Indian penal code, together with the codes of civil and criminal procedure, we have memorable examples of such efforts.

But, though the governor-general-in-council is theoretically supreme over every part of India alike, his actual authority is not everywhere exercised in the same direct manner. For ordinary purposes of administration British India is partitioned into provinces, each with a government of its own; and certain of the native states are attached to those provinces with which they are most nearly connected geographically. These provinces, again, enjoy various degrees of independence, in accordance with the course of their historical development. The two sister presidencies of Madras and Bombay still retain many marks of their original equality with Bengal. They each have an army and a civil service of their own. They are each administered by a governor appointed direct from England, with an executive and a legislative council, whose functions are analogous to those of the councils of the governor-general. They thus possess a domestic legislature; and in administrative matters, also, the interference of the viceroy is a somewhat remote contingency. Of the other provinces, Bengal, or rather Lower Bengal, occupies a peculiar position. Like the Northwestern Provinces and the Punjab, it is administered by a single official, with the style of lieutenant-governor, who is controlled by no executive council; but, unlike those two provinces, Bengal has a legislative council, so far preserving a sign of its early preëminence. The remaining provinces, whether ruled by a lieutenant-governor or by a chief commissioner, may be regarded from an historical point of view as fragments of the original Bengal presidency, which as thus defined would be coexten-

sive with all British India that is not appropriated either to Madras or to Bombay. The lieutenant-governors and most of the chief commissioners are chosen from the covenanted civil service. In executive matters they are the practical rulers; but, excepting the lieutenant-governor of Bengal, they have no legislative authority. To complete the total area of territory under British administration, it is necessary to add certain *quasi*-provinces, under the immediate control of the viceroy. These consist of Ajmír (Ajmere), transferred from Rájputána; Berar, or the districts assigned by the nizám of Hyderabad; the state of Mysore, which was restored in 1881 upon terms to its native rájá; and the tiny territory of Coorg, in the extreme south.

Another difference of administration, though now of less importance than in former times, derives its name from the old regulations, or uniform rules of law and practice which preceded the present system of acts of the legislature. These regulations, originally intended to be universal in their application, have been from time to time withdrawn so far as regards certain tracts of country which from their backward state of civilization or other causes seemed to require exceptional treatment. In non-regulation territory, broadly speaking, a larger measure of discretion is allowed to the officials, both in the collection of revenue and in the administration of civil justice; strict rules of procedure yield to the necessities of the case, and the judicial and executive departments are to a great extent combined in the same hands. Closely connected with this indulgence in favor of the personal element in administration, a wider field is also permitted for the selection of the administrative staff, which is not confined to the covenanted civil service, but includes military officers on the staff and also uncovenanted civilians. The title of the highest authority in a non-regulation district is not that of collector-magistrate, but deputy commissioner; and the supreme authority in a non-regulation province is usually styled, not lieutenant-governor, but chief commissioner. The Central Provinces and British Burmah are examples of non-regulation provinces; but non-regulation districts are to be found also in Bengal and the Northwestern Provinces, where their existence can always be traced by the office of deputy commissioner.

Alike in regulation and in non-regulation territory the unit of administration is the district—a word of very definite meaning in official phraseology. The district officer, whether known as collector-magistrate or as deputy commissioner, is the sole responsible head of his jurisdiction.

Upon his energy and character rests ultimately the efficiency of the Indian Government. Not only are his own special duties so numerous and so vast as to be bewildering to the outsider, but the work of his subordinates, European and native, largely depends upon the stimulus of his personal example. His position has been compared to that of the French *préfet*; but such a comparison is unjust in many ways to the Indian district officer: he is not a creature of the Home Office, who takes his color from his chief and represents only officialism, but an active worker in every department of popular well-being, with a large measure of individual initiative. As the very name of collector-magistrate implies, his main functions are twofold. He is a fiscal officer, charged with the collection of the revenue from land and other sources; and he is a civil and criminal judge of first instance. But this explanation of his title by no means exhausts his multifarious duties. He does in his local sphere all that the home secretary is supposed to do in England, and a great deal more; for he is the representative of a paternal and not of a constitutional government. Police, jails, education, municipal-

ities, roads, sanitation, dispensaries, are all to him matters of daily concern, while, in addition, he is expected to make himself acquainted with every phase of the social life of the natives and with each natural aspect of the country. Besides being a lawyer, an accountant, and a clerk, he ought also to possess no mean knowledge of agriculture, political economy, and engineering.

The total number of districts in British India is 238. They vary greatly in size and in number of inhabitants. The average area is 3,778 square miles, ranging from an average of 6,612 square miles in Madras to an average of 1,999 square miles in Oudh. The average population is 802,927, similarly ranging from an average of 1,508,219 in Madras to an average of 161,597 in Burmah. The Madras districts are thus both the largest and the most populous. In every province but Madras, the districts are grouped into larger areas, known as divisions, each under the charge of a commissioner. But these divisions are not properly units of administration, as the districts are. They are aggregates of units, formed only for convenience of supervision, so that an intermediate authority may exercise the universal watchfulness which would be impossible for a distant lieutenant-governor. The districts are again partitioned out into lesser tracts, which are strictly units of administration, though subordinate ones. The system of partitioning, and also the nomenclature, vary in the different provinces; but generally it may be said that the subdivision or *tahsíl* is the ultimate unit of administration. The double name indicates the twofold principle of separation: the subdivision is properly the charge of an assistant magistrate or executive officer, the *tahsíl* is the charge of a deputy-collector or fiscal officer; and these two offices may or may not be in the same hands. Broadly speaking, the subdivision is characteristic of Bengal, where revenue duties are in the background, and the *tahsíl* of Madras, where the land settlement requires attention year by year. There is no administrative unit below the subdivision or *tahsíl*. The *tháná*, or police division, only exists for police purposes. The *parganá*, or fiscal division under native rule, has now but an historical interest. The village still remains as the agricultural unit, and preserves its independence for revenue purposes in certain parts of the country. The township is peculiar to Burmah.

The judicial jurisdictions coincide for the most part with the magisterial and fiscal boundaries. But, except in Madras, where the districts are large, a single civil and sessions judge, *i. e.*, the supreme judicial officer under the high court, sometimes exercises jurisdiction over more than one district. As has been already mentioned, in non-regulation territory judicial and executive functions are combined in the same hands.

The preceding sketch of Indian administration would be incomplete without a reference to the secretariat, or central office, which in some sense controls and gives life to the whole. From the secretariat are issued the orders which regulate or modify the details of administration; into the secretariat come all the multifarious reports from the local officers, to be there digested for future reference. But though the secretaries may enjoy the advantages of life at the presidency capitals, with higher salaries and better prospects of promotion, it is recognized that the efficiency of the empire rests ultimately upon the shoulders of the district officers, who bear the burden and heat of the day, with few opportunities of winning fame or reward.

The existing system of education in India is mainly dependent upon the government, being directly organized by the state, at least in its higher departments, assisted throughout by grants-in-aid, and under careful in-

spection. The present system dates from 1854, being based upon a comprehensive dispatch sent out by Sir C. Wood (afterward Lord Halifax) in that year. At that time the three universities were founded at Calcutta, Madras, and Bombay; English-teaching schools were established in every district; the benefit of grants-in-aid was extended to the lower vernacular institutions and to girls' schools; and public instruction was erected into a department of the administration in every province, under a director, with a staff of inspectors. In some respects this scheme may have been in advance of the time; but it supplied a definite outline, which has gradually been filled up with each succeeding year of progress. A network of schools has now been spread over the country, graduated from the indigenous village institutions up to the highest colleges. All alike receive some measure of pecuniary support, which is justified by the guarantee of regular inspection; and a series of scholarships at once stimulates efficiency and opens a path to the university for children of the poor.

HISTORY.

Our earliest glimpses of India disclose two races struggling for the soil. The one was a fair-skinned people, who had lately entered by the northwestern passes—a people of Aryan (literally “noble”) lineage, speaking a stately language, worshiping friendly and powerful gods. The other was a race of a lower type, who had long dwelt in the land, and whom the lordly new-comers drove back before them into the mountains, or reduced to servitude on the plains. The comparatively pure descendants of these two races in India are now nearly equal in number, there being about eighteen millions of each; their mixed progeny, sprung chiefly from the ruder stock, make up the mass of the present Indian population.

The struggle is commemorated by the two names which the victors gave to the early tribes, namely, the *Dasyus*, or “enemies,” and the *Dásas*, or “slaves.” The last remains to this day the family name of multitudes of the lower class in Bengal.

Thrust back by the Aryans from the plains, these primitive peoples have lain hidden away in the recesses of the mountains, like the remains of extinct animals which zoölogists find in hill-caves. India thus forms a great museum of races, in which we can study man from his lowest to his highest stages of culture.

India may be divided into three regions. Two of these, the *Himálayas* in the north and the three-sided table-land in the south, still form the retreats of the non-Aryan tribes. The third, or the great river plains, became in very ancient times the theater on which a nobler race worked out its civilization.

We know little regarding these noble Aryan tribes in their early camping-ground in Central Asia. From words preserved in the languages of their long-separated descendants in Europe and India, scholars infer that they roamed over the grassy steppes with their cattle, making long halts to raise crops of grain. They had tamed most of the domestic animals, were acquainted with some metals, understood the arts of weaving and sewing, wore clothes, and ate cooked food. They lived the hardy life of the temperate zone, and the feeling of cold seems to be one of the earliest common remembrances of the eastern and western branches of the race. Ages afterward, when the Vedic singers in hot India prayed for long life, they asked for “a hundred winters.” The forefathers of the Greek and the Roman, of the Englishman and the Hindu, dwelt together in Asia, spoke the same tongue, worshiped the same gods. The languages of Europe and India, although at first sight they seem wide apart, are merely

different forms of the original Aryan speech. This is especially true of the common words of family life. The names for *father*, *mother*, *brother*, *sister*, and *widow* are the same in most of the Aryan languages, whether spoken on the banks of the Ganges, of the Tiber, or of the Thames. Thus the word *daughter*, which occurs in nearly all of them, has been derived from two Sanskrit roots meaning “to draw milk,” and preserves the memory of the time when the daughter was the little milkmaid in the primitive Aryan household.

The *Rig-Veda* forms the great literary memorial of the early Aryan settlements in the Punjab. The age of this venerable hymnal is unknown. The Hindus believe, without evidence, that it existed “from before all time,” or at least 3,001 years B.C.; nearly 5,000 years ago. European scholars have inferred from astronomical dates that its composition was going on about 1400 B.C. But these dates are themselves given in writings of later origin, and might have been calculated backward. We only know that the Vedic religion had been at work long before the rise of Buddhism in the sixth century B.C. The race progressed from a loose confederacy of tribes into several well-knit nations, each bound together by the strong central force of kingly power, directed by a powerful priesthood and organized on a firm basis of caste.

Certain families came to have, not only an hereditary claim to conduct the great sacrifices, but also the exclusive knowledge of the ancient hymns, or at any rate of the traditions which explained their symbolical meaning. They naturally tried to render the ceremonies solemn and imposing. By degrees a vast array of ministrants grew up around each of the greater sacrifices. There were first the officiating priests and their assistants, who prepared the sacrificial ground, dressed the altar, slew the victims, and poured out the libations; second, the chanters of the Vedic hymns; third, the reciters of other parts of the service; fourth, the superior priests, who watched over the whole, and corrected any mistakes.

Meanwhile other castes had been gradually formed. As the Aryans moved eastward from the Indus, some of the warriors were more fortunate than others, or received larger shares of the conquered lands. Such families had not to till their fields with their own hands, but could leave that work to be done by the aboriginal races whom they subdued. In this way there grew up a class of warriors, freed from the labor of husbandry, who surrounded the chief or king, and were always ready for battle. It seems likely that these kinsmen and “companions of the king” formed an important class among the early Aryan tribes in India, as they certainly did among the ancient branches of the race in Europe, and still do at the petty courts of India. Their old Sanskrit names, *Kshattriya*, *Rájanya*, and *Rájbansi*, mean “connected with the royal power,” or “of the royal line;” their usual modern name *Rájpút* means “of royal descent.” In process of time, when the Aryans settled down, not as mere fighting clans, but as powerful nations, in the middle land along the Jumna and Ganges, this warrior class grew in numbers and in power. The black races had been reduced to serfdom, or driven back into the *Himálayas* and the *Vindhya*s, on the north and the south of that fertile tract. The incessant fighting, which had formed the common lot of the tribes on their actual migration eastward from the Indus, ceased. A section of the people laid aside their arms, and devoted themselves to agriculture or other peaceful pursuits. The sultry heats of the Middle Land must also have abated their old northern energy, and led them to love repose. Those who, from family ties

or from personal inclination, preferred a soldier's life had to go beyond the frontier to find an enemy. Distant expeditions of this sort could be undertaken much less conveniently by the husbandman than in the ancient time, when his fields lay on the very border of the enemy's country, and had just been wrested from it. Such expeditions required and developed a class of regular soldiers whose presence was not constantly needed at home for tilling the land. The old warrior companions and kinsmen of the king formed a nucleus round which gathered all the more daring spirits, and laid the foundation of a military caste. The Aryans on the Ganges, in the "Middle Land," thus found themselves divided into three classes—first, the priests, or Bráhmans; second, the warriors and king's companions, called in ancient times Kshattriyas, at the present day Rájputs; third, the husbandmen, or agricultural settlers, who retained the old name of Vaisyas, from the root *vis*, which in the Vedic period had included the whole "people." These three classes gradually became distinct castes; intermarriage between them ceased, and each kept more and more strictly to its hereditary employment. But they were all recognized as belonging to the "twice-born" or Aryan race, were all present at the great national sacrifices, and all worshiped the same bright gods. Beneath them was a fourth or servile class, called Súdras, the remnants of the vanquished aboriginal tribes whose lives had been spared. These were "the slave-bands of black descent," the Dásas of the *Veda*.

The Súdras had no rights, and, once conquered, ceased to struggle against their fate. But a long contest raged between the priests and warriors for the chief place in the Aryan commonwealth.

In order to understand that contest, we must go back to the time when the priests and warriors were simply fellow-tribesmen. The priestly or Bráhman caste grew slowly out of the families of Rishis who composed the Vedic hymns, or were chosen to conduct the great tribal sacrifices. In after times the whole Bráhman population of India pretended to trace their descent from seven Rishis. But the composers of the Vedic hymns were sometimes kings or distinguished warriors rather than priests; the *Veda* itself speaks of these royal Rishis (*Rájarshis*). When the Bráhmans put forward their claim to the highest rank, the warriors or Kshattriyas were slow to admit it; and, when the Bráhmans went a step farther, and declared that only members of their families could be priests, or gain admission into the priestly caste, the warriors disputed their pretensions. In later ages the Bráhmans, having the exclusive keeping of the sacred writings, effaced from them, as far as possible, all traces of the struggle. They taught that their caste had come forth from the mouth of God, divinely appointed to the priesthood from the beginning of time. Nevertheless, a large body of Vedic verses and Sanskrit texts has now been brought to bear upon the struggle between the Bráhmans and Kshattriyas for the highest rank.

The Bráhmans were not merely the depositaries of the sacred books, the philosophy, the science, and the laws of the ancient Hindu commonwealth; they were also the creators and custodians of its secular literature. They had a practical monopoly of Vedic learning, and their policy was to trace back every branch of knowledge and intellectual effort to the *Veda*.

In order to understand the long domination of the Bráhmans and the influence which they still wield, it is necessary to keep in mind their position as the great literary caste. Their priestly supremacy has been repeatedly assailed, and was during a space of several hundred years overthrown. But throughout twenty-

two centuries they have been the counselors of Hindu princes and the teachers of the Hindu people. They represent the early Aryan civilization of India; and the essential history of the Hindus is a narrative of the attacks upon the continuity of that civilization—that is to say, of attacks upon the Bráhmanical system of the Middle Land, and of the modifications and compromises to which that system has had to submit. Those attacks range themselves under six epochs: first, the religious uprising of the half-Bráhmanized Aryan tribes on the east of the Middle Land, initiated by the preaching of Buddha in the sixth century B.C., culminating in the Buddhist kingdoms about the commencement of our era, and melting into modern Hinduism about the eighth century A.D.; second, warlike inroads of non-Bráhmanical Aryans or other races from the west, commencing with the Greek invasions in the fourth century B.C., and continuing under the Græco-Bactrian empire and its successors to probably the third or fifth century A.D.; third, the influence of the non-Aryan tribes of India and of the non-Aryan low-castes incorporated from them—an influence ever at work, indeed by far the most powerful agent in dissolving Bráhmanism into Hinduism, but represented in a special manner by the non-Aryan kingdoms about the seventh and eighth centuries A.D.; fourth, the reaction against the low beliefs, priestly oppression, and bloody rites which resulted from this compromise between Bráhmanism and aboriginal worship, a reaction which received an impetus from the preaching of Sankar-Achárjya, who founded a philosophical Siviate sect in the eighth or ninth century, and received its full development under a line of great Vishnuvite reformers from the twelfth to the sixteenth centuries A.D.; fifth, Mahometan invasions and the rule of Islám, 1000 to 1765 A.D.; sixth, the English supremacy, and the great popular upheaval which it has produced in the eighteenth and nineteenth centuries.

Buddhist Period.

The first great solvent of Bráhmanism was the teaching of Buddha. The life of this celebrated man has three sides—its personal aspects, its legendary developments, and its religious consequences upon mankind. In his own person Buddha appears as a prince and preacher of ancient India. In the legendary developments of history Buddha ranks as a divine teacher among his followers, as an incarnation of Vishnu among the Hindus, and apparently as a saint of the Christian church, with a day assigned to him in both the Greek and Roman calendars. As a religious founder he left behind him a system of beliefs which has gained more disciples than any other creed in the world, and which, after a lapse of twenty-four centuries, is now professed by 500,000,000 of people, or more than one-third of the human race. The life of Buddha is related a length under BUDDHISM.

Buddhism never ousted Bráhmanism from any large part of India. The two systems coëxisted as popular religions during more than 1,000 years (244 B.C. to about 800 A.D.), and modern Hinduism is the joint product of both.

Greek-Roman Period.

The external history of India commences with the Greek invasion in 327 B.C. Alexander the Great entered India early in 327 B.C., crossed the Indus above Attock, and advanced, without a struggle, over the intervening territory of the Taxiles to the Jhelum (Hydaspes). He found the Punjab divided into petty kingdoms, jealous of each other, and most of them inclined to join an invader rather than to oppose him. One of these local monarchs, Porus, disputed the passage of the Jhelum. His son fell early in the onset;

Porus himself fled, wounded, but, on tendering his submission, was confirmed in his kingdom, and became the conqueror's trusted friend.

Alexander built two memorial cities on the scene of his victory—Bucephalia on the west bank, near the modern Jalápur, named after his beloved charger slain in the battle, and Nicæa, the present Mong, on the east side of the river.

Alexander advanced southeast through the kingdom of the younger Porus to Amritsar, and, after a sharp bend backward to the west, to fight the Cathæi at Sangala, he reached the Beas (Hyphasis). There, at a spot not far from the modern battlefield of Sobráon, he halted his victorious standards. He had resolved to march to the Ganges; but his troops were worn out by the heats of the Punjab summer, and their spirits broken by the hurricanes of the southwest monsoon. The native tribes had already risen in his rear, and the conqueror of the world was forced to turn back before he had crossed even the frontier province of India. The Sutlej, the eastern districts of the Punjab, and the mighty Jumna still lay between him and the Ganges. A single defeat might be fatal to his army; if the battle on the Jhelum had not gone in his favor, not a Greek would have reached the Afghán side of the passes. Yielding at length to the clamor of his troops, he led them back to the Jhelum. He there embarked 8,000 of them in boats previously prepared, and floated down the river; the remainder of his army marched in two divisions along the banks.

The country was hostile, and the Greeks held only the land on which they encamped. At Múltán (Mooltan), then as now the capital of the southern Punjab, he had to fight a pitched battle with the Malli, and was severely wounded in taking the city. His enraged troops put every soul within it to the sword. Farther down, near the confluence of the five rivers of the Punjab, he made a long halt, built a town—Alexandria, the modern Uchch—and received the submission of the neighboring states. A Greek garrison and satrap, left there by Alexander, laid the foundation of a lasting influence. Having constructed a new fleet suitable for the greater rivers on which he was now to embark, he proceeded southward through Sind, and followed the course of the Indus until he reached the ocean. In the apex of the delta he founded a city, Patala, which remains to this day under the name of Hyderabad, the capital of Sind. At the mouth of the Indus Alexander beheld for the first time the majestic phenomenon of the tides. One part of his army he shipped off under the command of Nearchus to coast along the Persian Gulf; the other he himself led through southern Baluchistán and Persia to Susa, where, after terrible losses from want of water and famine on the march, he arrived in 325 B.C.

During his two years' campaign in the Punjab and Sind, Alexander captured no province, but he made alliances, founded cities and planted garrisons. He had transferred much territory to chiefs and confederacies devoted to his cause; every petty court had its Greek faction; and the detachments which he left behind at various positions, from the Afghán frontier to the Beas, and from near the base of the Himálayas to the Sind delta, were visible pledges of his return. At Taxila (Deri-Shahan) and Nicæa (Mong) in the northern Punjab, at Alexandria (Uchch) in the southern Punjab, at Patala (Hyderabad) in Sind, and at other points along his route, he established military settlements of Greeks or allies. A large body of his troops remained in Bactria; and, in the partition of the empire which followed Alexander's death in 323 B.C., Bactria and India eventually fell to Seleucus Nicator, the founder of the Syrian monarchy.

Meanwhile a new power had arisen in India. Among

the Indian adventurers who thronged Alexander's camp in the Punjab, each with his plot for winning a kingdom or crushing a rival, Chandra Gupta, an exile from the Gangetic valley, seems to have played a somewhat ignominious part. He tried to tempt the wearied Greeks on the banks of the Beas with schemes of conquest in the rich southeastern provinces; but, having personally offended their leader, he had to fly the camp, (326 B.C.) In the confused years which followed, he managed, with the aid of plundering hordes, to form a kingdom on the ruins of the Nanda dynasty in Magadha, or Behar, (316 B.C.) He seized the capital, Pataliputra, the modern Patná, established himself firmly in the Gangetic valley, and compelled the northwestern principalities, Greeks and natives alike, to acknowledge his suzerainty. While, therefore, Seleucus was winning his way to the Syrian monarchy during the eleven years which followed Alexander's death, Chandra Gupta was building up an empire in northern India. Seleucus reigned in Syria from 312 to 280 B.C., Chandra Gupta in the Gangetic valley from 316 to 292 B.C. In 312 B.C. the power of both had been consolidated, and the two new sovereignties were soon brought face to face.

Scythic and Non-Aryan Influences.

About 126 B.C. the Tartar tribe of Su is said to have driven out the Greek dynasty from Bactria, and the Græco-Bactrian settlements in the Punjab were overthrown by the Tue-Chi. The Scythian migrations toward India culminated in the empire of Kanishka, who held the fourth Buddhist council, *circa* 40 A.D., and practically became the royal founder of northern Buddhism. The Scythic element played an important part in the history of northern India. Under Kanishka and his successors a connection was established with the Buddhist nations of central and eastern Asia, traces of which survived to the time of Hwen Tsang (629–645 A.D.) in the name of China-pati, about ten miles to the west of the Beas river. China-pati is said to have been the town which Kanishka appointed for the residence of his Chinese hostages.

An effort has been made to trace Buddha himself to a Scythic origin. Whatever may be the value of this conjecture, the influence of the Scythian dynasties in northern India is an historical fact. The northern or Tibetan form of Buddhism, represented by Kanishka and his council in 40 A.D., made its way down to the plains of Hindustán, and, during the next six centuries, competed with the earlier Buddhism of Asoka. Many scholars believe that the Scythians poured down upon India in such masses as to supplant the previous population.

The Scythic settlement was not effected without a struggle. As Chandra Gupta advanced from the Gangetic valley, and rolled back the tide of Græco-Bactrian conquest (*circa* 312–306 B.C.), so the Indian heroes of the first century before and after Christ are native princes who stemmed the torrent of Scythian invasion. Vikramáditya, king of Ujjain, won his paramount place in Indian story by driving out the invaders.

Mahometan Period.

At the very time that Buddhism was being crushed out of India by the Bráhmanic reaction, a new faith was being born in Arabia, destined to supply a youthful fanaticism which should sweep the country from the Himálayas to Cape Comorin, and from the western to the eastern sea. Muhammad, commonly known as Mahomet, the founder of Islám, died at Medina in 632 A.D., while the Chinese pilgrim Hwen Tsang was still on his travels. The first Mahometan invasion of India is placed in 664, only thirty-two years after the death of the prophet. The Punjab is said to have been ravaged on

this occasion with no permanent results. The first Mahometan conquest was the outlying province of Sind, which from the point of view of geology may be regarded as a continuation of the desert of Baluchistán. In 711, or seventy-nine years after the death of Mahomet, an Arab army under Muhammad Kásim invaded and conquered the Hindus of Sind in the name of Walid I., caliph of Damascus, of the Bene-Umyyeh line. In the same year Roderic, the last of the Goths, fell before the victorious Saracens in Spain. But in India the bravery of the Rájputs and the devotion of the Bráhmans seem to have afforded a stronger national bulwark than existed in western Europe. In 750 the Hindus rose in rebellion and drove out the Musalmán tyrant, and the land had rest for 150 years.

The next Mahometan invasion of India is associated with the name of Sultán Mahmúd of Ghazní. Mahmúd was the eldest son of Sabuktágín, surnamed Nasr-ud-dín, in origin a Turkish slave, who had established his rule over the greater part of modern Afghánistán and Khorasán with Ghazní as his capital. In 977 Sabuktágín is said to have defeated Jáipal, the Hindu rájá of Lahore, and to have rendered the Punjab tributary. But his son Mahmúd was the first of the great Musalmán conquerors whose names still ring through Asia. Mahmúd succeeded to the throne in 997. During his reign of thirty-three years he extended the limits of his father's kingdom from Persia on the east to the Ganges on the west; and it is related that he led his armies into the plains of India no less than seventeen times. In 1001 he defeated Rájá Jáipal a second time, and took him prisoner. But Anandpal, the son of Jáipal, raised again the standard of national independence, and gathered an army of Rájput allies from the farthest corners of Hindustán. The decisive battle was fought in the valley of Pesháwar. Mahmúd won the day by the aid of his Turkish horsemen, and thenceforth the Punjab has been a Mahometan province, except during the brief period of Síkh supremacy.

The Afghans of Ghor or Ghur rose to power on the downfall of the Turks of Ghazní. The founder of the family is said to have been Izzud-dín al Husáin, whose son Allah-ud-dín destroyed Ghazní. Allah-ud-dín had two nephews, Ghíyás-ud-dín and Muiz-ud-dín, the latter of whom, also called Shahab-ud-dín by Musalmán chroniclers, and generally known in history as Muhammad Ghori, is the second of the great Mahometan conquerors of India. In 1176 he took Múltán and Uchch; in 1187 Lahore fell into his hands; in 1191 he was repulsed before Delhi, but soon afterward he redeemed this disaster. Hindustán Proper was at that period divided between the two Rájput kingdoms of Kanauj and Delhi. Muhammad Ghori achieved his object by playing off the rival kings against each other. By 1193 he had extended his conquests as far east as Benares, and the defeated Rájputs migrated in a body to the hills and deserts now known as Rájputána. In 1199 one of his lieutenants, named Bakhtiyar, advanced into Bengal, and expelled by an audacious stratagem the last Hindu rájá of Nadiyá. The entire northern plain, from the Indus to the Brahmaputra, thus lay under the Mahometan yoke. But Muhammad Ghori never settled himself permanently in India. His favorite residence is said to have been the old capital of Ghazní, while he governed his Indian conquests through the agency of a favorite slave, Kutab-ud-dín. Muhammad Ghori died in 1206, being assassinated by some Ghakkar tribesmen while sleeping in his tent by the bank of the Indus; on his death both Ghor and Ghazní drop out of history, and Delhi first appears as the Mahometan capital of India.

On the death of Muhammad Ghori, Kutab-ud-dín at
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once laid aside the title of viceroy, and proclaimed himself sultán of Delhi. He was the founder of what is known as the slave dynasty, which lasted for nearly a century (1206-1288).

In 1294 Allah-ud-dín Khiljí, the third of the great Mahometan conquerors of India, raised himself to the throne of Delhi by the treacherous assassination of his uncle Firoz II., who had himself supplanted the last of the slave dynasty. Allah-ud-dín died in 1316, having subjected to Islám the Deccan and Guzerat. Three of his descendants followed him upon the throne, but their united reigns extended over only five years. In 1321 a successful revolt was headed by Ghiyas-ud-dín Tughlak, governor of the Punjab, who is said to have been of Turkish origin. The Tughlak dynasty lasted for about seventy years, until it was swept away by the invasion of Timúr, the fourth Mahometan conqueror of India, in 1398.

When Timúr invaded India in 1398, he encountered but little organized resistance. Mahmúd, the last of the Tughlak dynasty, being defeated in a battle outside the walls of Delhi, fled into Guzerat. The city was sacked and the inhabitants massacred by the victorious Mughals. But the invasion of Timúr left no permanent impress upon the history of India, except in so far as its memory fired the imagination of Bábar (Baber), the founder of the Mughal dynasty.

In 1525 Bábar (Baber), the fifth in descent from Timúr, and also the fifth Mahometan conqueror, invaded India at the instigation of the governor of the Punjab, won the victory of Pánipat over Ibráhim, the last of the Lodi dynasty, and founded the Mughal empire, which lasted, at least in name, until 1857.

In 1739 Nádir Sháh of Persia, the sixth and last of the great Mahometan conquerors of India, swept like a whirlwind over Hindustán, and sacked the imperial city of Delhi. Thenceforth the Great Mughal (Mogul) became a mere name, though the hereditary succession continued unbroken down to our own day. Real power had passed into the hands of Mahometan courtiers and Marhattá generals, both of whom were then carving for themselves kingdoms out of the dismembered empire, until at last British authority placed itself supreme over all.

Early European Settlements.

Mahometan invaders have always entered India from the northwest. Her new conquerors approached from the sea and from the south. In 1492 Christopher Columbus set sail under the Spanish flag to seek India beyond the Atlantic, bearing with him a letter to the great khan of Tartary. The expedition under Vasco da Gama started from Lisbon five years later, and, doubling the Cape of Good Hope, cast anchor off the city of Calicut on May 20, 1498, after a prolonged voyage of nearly eleven months.

After staying nearly six months on the Malabar coast, Da Gama returned to Europe by the same route as he had come. If the West Indies belonged to Spain by priority of discovery, Portugal might claim the East Indies by the same right. Territorial ambition conspired with the spirit of proselytism and with the greed of commerce to fill all Portuguese minds with the dream of a mighty Oriental empire. The early Portuguese discoverers were not traders or private adventurers, but admirals with a royal commission to conquer territory and promote the spread of Christianity.

For exactly a century, from 1500 to 1600, the Portuguese enjoyed a monopoly of Oriental trade.

The Dutch were the first European nation to break through the Portuguese monopoly. During the sixteenth century Bruges, Antwerp, and Amsterdam became suc-

cessively the great emporia whence Indian produce, imported by the Portuguese, was distributed to Germany, and even to England. At first the Dutch, following in the track of the English, attempted to find their way to India by sailing round the north coasts of Europe and Asia. William Barents is honorably known as the leader of three of these arctic expeditions, in the last of which he perished. The first Dutchman to double the Cape of Good Hope was Cornelius Houtman, who reached Sumatra and Bantam in 1596. Forthwith private companies for trade with the East were formed in many parts of the United Provinces, but in 1602 they were all amalgamated by the states-general into "The Dutch East India Company." Within a few years the Dutch had established factories on the continent of India, in Ceylon; in Sumatra, on the Persian Gulf, and on the Red Sea, besides having obtained exclusive possession of the Moluccas. In 1618 they laid the foundation of the city of Batavia in Java, to be the seat of the supreme government of the Dutch possessions in the East Indies, which had previously been at Amboyna. At about the same time they discovered the coast of Australia, and in North America founded the city of New Amsterdam, or Manhattan, now New York. During the seventeenth century the Dutch maritime power was the first in the world. The massacre of Amboyna in 1623 led the English East India Company to retire from the Eastern seas to the continent of India, and thus, though indirectly, contributed to the foundation of the British Indian empire. The long naval wars and bloody battles between the English and the Dutch within the narrow seas were not terminated until William of Orange united the two crowns in 1689. In the far East the Dutch ruled without a rival, and gradually expelled the Portuguese from almost all their territorial possessions. In 1635 they occupied Formosa; in 1640 they took Malacca, a blow from which the Portuguese never recovered; in 1651 they founded a colony at the Cape of Good Hope, as a half-way station to the East; in 1658 they captured Jaffnapatam, the last stronghold of the Portuguese in Ceylon; in 1664 they wrested from the Portuguese all their earlier settlements on the pepper-bearing coast of Malabar. The rapid and signal downfall of the Dutch colonial empire is to be explained by its short-sighted commercial policy. It was deliberately based upon a monopoly of the trade in spices, and remained from first to last destitute of the true imperial spirit.

The knell of Dutch supremacy was sounded by Clive, when in 1758 he attacked the Dutch at Chinsurah both by land and water, and forced them to an ignominious capitulation. In the great French war from 1781 to 1811 England wrested from Holland every one of her colonies, though Java was restored in 1816 and Sumatra in exchange for Malacca in 1824. At the present time the Dutch flag flies nowhere on the mainland of India.

The earliest English attempts to reach India were made by the Northwest Passage. In 1496 Henry VII. granted letters patent to John Cabot and his three sons (of whom one was the better known Sebastian) to fit out two ships for the exploration of that route. They failed, but discovered the island of Newfoundland, and sailed along the coast of America from Labrador to Virginia. In 1553 the ill-fated Sir Hugh Willoughby attempted to force a passage along the north of Europe and Asia, the successful accomplishment of which has been reserved for a Swedish savant of our own generation. Sir Hugh perished miserably, but his second in command, Chancellor, reached a harbor on the White Sea, now Archangel. Thence he penetrated by land to the court of the grand-duke of Moscow, and laid the foundation of "the Russia Company for carrying on the overland

trade between India, Persia, Bokhara, and Moscow." Many subsequent attempts were made at the Northwest Passage from 1576 to 1616, which have left on our modern maps the imperishable names of Frobisher, Davis, Hudson, and Baffin. Meanwhile, in 1577, Sir Francis Drake had circumnavigated the globe, and on his way home had touched at Ternate, one of the Moluccas, the king of which island agreed to supply the English nation with all the cloves it produced. The first Englishman who actually visited India was Thomas Stephens, in 1579, unless there be any foundation in fact for the statement of William of Malmesbury, that in the year 883 Sigheimus of Sherborne, being sent by King Alfred to Rome with presents to the pope, proceeded from thence to the East Indies to visit the tomb of St. Thomas at Mylapore (Mailapur, also called Saint Thomé, a suburb of Madras), and brought back with him a quantity of jewels and spices. Stephens was educated at New College, Oxford, and was rector of the Jesuits' College in Salsette. His letters to his father are said to have roused great enthusiasm in England to trade directly with India. In 1583 three English merchants, Ralph Fitch, James Newberry, and Leedes, went out to India overland as mercantile adventurers. The jealous Portuguese threw them into prison at Ormuz, and again at Goa. At length Newberry settled down as a shopkeeper at Goa, Leedes entered the service of the Great Moghal, and Fitch, after a lengthened peregrination in Ceylon, Bengal, Pegu, Siam, Malacca, and other parts of the East Indies, returned to England.

The defeat of the "Invincible Armada" in 1588, at which time the crowns of Spain and Portugal were united, gave a fresh stimulus to maritime enterprise in England; and the successful voyage of Cornelius Houtman in 1596 showed the way round the Cape of Good Hope into waters hitherto monopolized by the Portuguese.

The foundation of the English East India Company was on this wise:—"In 1599 the Dutch, who had now firmly established their trade in the East, having raised the price of pepper against us from 3s. per pound to 6s. and 8s., the merchants of London held a meeting on September 22d at Founders' Hall, with the lord mayor in the chair, and agreed to form an association for the purpose of trading directly with India. Queen Elizabeth also sent Sir John Mildenhall by Constantinople to the Great Moghal to apply for privileges for the English company, for which she was then preparing a charter, and on December 31, 1600, the English East India Company was incorporated by royal charter under the title of 'The Governor and Company of Merchants of London trading to the East Indies.'" The original company had only 125 shareholders, and a capital of £70,000, which was raised to £400,000, in 1612, when voyages were first undertaken on the joint-stock account. Courten's association, known also as "The Assada Merchants," from a factory founded by them in Madagascar, was established in 1635, but, after a period of internecine rivalry, united with the London Company in 1650. In 1655, the "Company of Merchant Adventurers" obtained a charter from Cromwell to trade with India, but united with the original company two years later. A more formidable rival subsequently appeared in the English company, or "General Society trading to the East Indies," which was incorporated under powerful patronage in 1698, with a capital of £2,000,000. According to Evelyn, in his *Diary* for March 5, 1698, "the old East India Company lost their business against the new company by ten votes in parliament, so many of their friends being absent, going to see a tiger baited by dogs." However,

a compromise was speedily effected through the arbitration of Lord Godolphin in 1702, and the London and the English companies were finally amalgamated in 1709, under the style of "The United Company of Merchants of England trading to the East Indies." At the same time the Company advanced a loan to the State of £3,190,000 at 3 per cent. interest, in consideration of the exclusive privilege to trade to all places between the Cape of Good Hope and the Straits of Magellan.

The early voyages of the Company, from 1600 to 1612, are distinguished as the "separate voyages," twelve in number. The subscribers individually bore the expenses of each voyage, and reaped the whole profits. With the exception of the fourth, all these separate voyages were highly prosperous, the profits hardly ever falling below 100 per cent. After 1612 the voyages were conducted on the joint-stock account.

British Empire (1765 to 1890).

The political history of the British in India begins in the eighteenth century with the French wars in the Carnatic. Fort St. George, the nucleus of Madras, was their earliest territorial possession, properly so called, in India, having been founded by Thomas Day in 1639. The land on which it stood, with an area round of about five miles in length by one mile in breadth, was purchased from the rajah of Chandragiri, who claimed to be the lineal descendant of the Hindu emperors of Vijayanagar. The French settlement of Pondicherry, about 100 miles lower down the Coromandel coast, was established in 1672, and for many years the English and French traded side by side, without either active rivalry or territorial ambition. The English, especially, appear to have been submissive to the native powers at Madras no less than in Bengal. They paid their annual rent of 1,200 pagodas (say £500) to the deputies of the Mughal empire when Aurangzeb annexed the south, and on two several occasions bought off a besieging army with a heavy bribe.

On the death of Aurangzeb in 1707, the whole of southern India became practically independent of Delhi. In the Deccan Proper, the Nizam-ul-Mulk founded an independent dynasty, with Hyderabad for its capital, which exercised a nominal sovereignty over the entire south. The Carnatic, or the lowland tract between the central plateau and the eastern sea, was ruled by a deputy of the nizam, known as the nawab of Arcot, who in his turn asserted claims to hereditary sovereignty. Further south, Trichinopoly was the capital of a Hindu rajah, and Tanjore formed another Hindu kingdom under a degenerate descendant of the line of Sivaji. Inland, Mysore was gradually growing into a third Hindu state, while everywhere local chieftains, called *palegars* or *naiks*, were in semi-independent possession of citadels or hill-forts.

In that condition of affairs the flame of war was kindled between the English and the French in Europe in 1745. Dupleix was at that time governor of Pondicherry, and Clive was a young writer at Madras. An English fleet first appeared on the Coromandel coast, but Dupleix by a judicious present induced the nawab of Arcot to interpose and prevent hostilities. In 1746 a French squadron arrived, under the command of La Bourdonnais. Madras surrendered almost without a blow, and the only settlement left to the English was Fort St. David, a few miles south of Pondicherry, where Clive and a few other fugitives sought shelter. The nawab, faithful to his policy of impartiality, marched with 10,000 men to drive the French out of Madras, but he was signally defeated by a French force of only 400 men and two guns. In 1748 an English fleet arrived under Admiral Boscawen and attempted the siege of Pondicherry, while a land force co-operated under Major Lawrence, whose name afterward became associated with that of Clive. The French successfully repulsed all attacks, and at last peace was restored by the treaty of Aix-la-Chapelle, which gave back Madras to the English (1748).

The first war with the French was merely an incident in the greater contest in Europe. The second war had its origin in Indian politics, while England and France were at peace. The easy success of the French arms had inspired Dupleix with the ambition of founding a French empire in India, under the shadow of the existing Mahometan powers. Disputed successions at Hyderabad and at Arcot supplied him with the opportunity that he lacked. On both thrones he placed nominees of his own, and for a short time posed as the supreme arbiter of the entire south. In boldness of conception, and in knowledge of Oriental diplomacy, Dupleix has had probably no rival. But he was no soldier, and he was destined in that sphere to encounter the "heaven-born genius" of Clive. For the English of Madras, under the instinct of self-preservation, were compelled to maintain the cause of another candidate to the throne of Arcot in op-

position to the nominee of Dupleix. This candidate was Muhammad Ali, afterward known in history as Wala-jah. The war that then ensued between the French and English, each with their native allies, has been exhaustively described in the pages of Orme. The one incident that stands out conspicuously is the capture and subsequent defense of Arcot by Clive in 1751. This heroic feat, even more than the battle of Plassey, established the reputation of the English for valor throughout India. Shortly afterward Clive returned to England in ill-health, but the war continued fitfully for many years. On the whole, English influence predominated in the Carnatic, and their candidate, Muhammad Ali, maintained his position at Arcot. But the French were no less supreme in the Deccan, whence they were able to take possession of the coast tract called "the Northern Circars." The final struggle was postponed until 1760, when Colonel (afterward Sir Eyre) Coote won the decisive victory of Wandewash over the French general Lally, and proceeded to invest Pondicherry, which was starved into capitulation in January, 1761. A few months later the hill-fortress of Gingee (Chenji) also surrendered. In the words of Orme, "that day terminated the long hostilities between the two rival European powers in Coromandel, and left not a single ensign of the French nation avowed by the authority of its government in any part of India."

Meanwhile the interest of history shifts with Clive to Bengal. The first English settlement in that part of India was Pippli in Orissa, to which the East India Company was permitted to trade in 1633, six years before the foundation of Madras. The river on which Pippli stood has since silted up, and the very site of the English settlement is now unknown and undiscoverable. In 1642 factories were opened at Balasore and Hugli (Hooghly), and in 1681 Bengal was erected into a presidency, as yet subject to Madras. The name of Calcutta is not heard of till 1686, when Job Charnock, the chief at Hooghly, was expelled by the deputy of Aurangzeb, and settled lower down the river on the opposite bank. There he acquired a grant of the three pretty villages of Sutanati, Gobindpur, and Kalighat (Calcutta), and founded the original Fort William in 1696.

At the time of Aurangzeb's death in 1707 the nawab or governor of Bengal was Murshid Kuli Khan, known also in European history as Jafar Khan. By birth a Brahman, and brought up as a slave in Persia, he united the administrative ability of a Hindu to the fanaticism of a renegade. Hitherto the capital of Bengal had been at Dacca on the eastern frontier of the empire, whence the piratical attacks of the Portuguese and of the Arakanese or Maghs could be most easily checked. Murshid Kuli Khan transferred his residence to Murshidabad (Moorshedabad), in the neighborhood of Kasimbazar (Cossimbazar), the river port of all the Ganges trade. The English, the French, and the Dutch had each factories at Kasimbazar, as well as at Dacca, Patna, and Maldah. But Calcutta was the headquarters of the English, Chandarnagar of the French, and Chinsurah of the Dutch, all three towns being situated close to each other in the lower reaches of the Hooghly, where the river is navigable for large ships. Murshid Kuli Khan ruled over Bengal prosperously for twenty-one years, and left his power to a son-in-law and a grandson. The hereditary succession was broken in 1740 by Ali Vardi Khan, who was the last of the great nawabs of Bengal. In his days the Marhatta horsemen began to ravage the country, and the English at Calcutta obtained permission to erect an earthwork, which is known to the present day as the Marhatta ditch. Ali Vardi Khan died in 1756, and was succeeded by his grandson, Siraj-ud-Daula (Surajah Dowlah), a youth of only eighteen years, whose ungovernable temper led to a rupture with the English within two months after his accession. In pursuit of one of his own family, who had escaped from his vengeance, he marched upon Calcutta with a large army. Many of the English fled down the river in their ships. The remainder surrendered after a feeble resistance, and were thrown as prisoners into the "black hole" or military jail of Fort William, a room about eighteen feet square, with only two small windows barred with iron. It was the month of June, in which the tropical heat of Calcutta is most oppressive. When the door of the prison was opened in the morning, only twenty-three persons out of one hundred and forty-six were found alive.

The news of this disaster fortunately found Clive returned to Madras, where also was a squadron of king's ships under Admiral Watson. Clive and Watson promptly sailed to the mouth of the Ganges with all the troops that could be got together. Calcutta was recovered with little fighting, and the nawab consented to a peace which restored to the company all their privileges and gave them compensation for their losses of property. It is possible that matters might have ended here if a fresh cause of hostilities had not suddenly arisen. War had just been declared between the English and French in Europe, and Clive, following the traditions of his early warfare in the Carnatic, attacked and captured Chandarnagar. Siraj-ud-Daula, exasperated by that breach of neutrality within his own dominions, took the side of the French. But Clive, again acting upon the policy he had learned from Dupleix, had provided himself with a rival candidate to the throne. Undaunted, he marched out to the battlefield of Plassey (Palasi), at the head of about 1,000 Europeans

and 2,100 sepoys, with nine pieces of artillery. The Mahometan army is said to have consisted of 50,000 foot, 18,000 horse, and 50 pieces of cannon. But there was a traitor in the Mahometan camp in the person of Mir Jafar, who had married a sister of the late nawab, Ali Vardi Khan. The battle was short but decisive. After a few rounds of artillery fire, Suraj-ud-Daula fled, and the road to Murshidabad was left open.

The battle of Plassey was fought on June 23, 1757, an anniversary afterward remembered when the mutiny was at its height in 1857. History has agreed to adopt this date as the beginning of the British empire in the East, but the immediate results of the victory were comparatively small, and several more hard-won fights were fought before even the Bengalis would admit the superiority of the British arms. For the moment, however, all opposition was at an end. Clive, again following in the steps of Dupleix, placed his nominee, Mir Jafar, upon the *masnad* at Murshidabad, being careful to obtain a patent of investiture from the Mughal court. Enormous sums were exacted from Mir Jafar as the price of his elevation. The company claimed 10,000,000 rupees as compensation for losses; for the English, the Indian, and the Armenian inhabitants of Calcutta there were demanded the sums of 5,000,000, 2,000,000, and 700,000 rupees; for the squadron 2,500,000 rupees, and an equal sum for the army. The members of the council received the following amounts: Mr. Drake, the governor, and Colonel Clive 280,000 rupees each; and Mr. Becker, Mr. Watts, and Major Kilpatrick 240,000 rupees each. The whole amounted to £2,697,750. The English, deluded by their avarice, still cherished extravagant ideas of Indian wealth; nor would they listen to the ungrateful truth. But it was found that there were no funds in the treasury to satisfy their inordinate demands, and they were obliged to be contented with one-half the stipulated sums, which, after many difficulties, were paid in specie and in jewels, with the exception of 584,905 rupees. The shares of the council were, however, paid in full. At the same time the nawab made a grant to the Company of the *zamindari* rights over an extensive tract of country around Calcutta, now known as the district of the Twenty-four Parganas. The area of this tract was about 882 square miles, and it paid a permanent revenue or quit-rent of about £23,000. The gross rental at first payable to the Company was £53,000, but within a period of ten years it had risen to £146,000. Originally the Company possessed only the *zamindari* rights, *i.e.*, revenue jurisdiction. The superior lordship, or right to receive the quit-rent, remained with the nawab; but in 1759 this also was parted with by the Delhi emperor, the nominal suzerain of the nawab, in favor of Clive, who thus became the landlord of his own masters, the Company. At that time, also, Clive was enrolled among the nobility of the Mughal empire, with the rank of commander of 6,000 foot and 5,000 horse. Clive's *jagir*, as it was called, subsequently became a matter of inquiry in England, and on his death it passed to the Company, thus merging the *zamindari* in the proprietary rights.

In 1758 Clive was appointed by the court of directors the first governor of all the Company's settlements in Bengal. From two quarters troubles threatened, which perhaps Clive alone was capable of overcoming. On the west the *shahzada* or imperial prince, known afterward as the emperor Shah Alam, with a mixed army of Afghans and Marhattas, and supported by the nawab wazir of Oudh, was advancing his own claims to the province of Bengal. In the south the influence of the French under Lally and Bussy was overshadowing the British at Madras. But the name of Clive exercised a decisive effect in both directions. Mir Jafar was anxious to buy off the *shahzada*, who had already invested Patna. But Clive in person marched to the rescue, with an army of only 450 Europeans and 2,500 sepoys, and the Mughal army dispersed without striking a blow. In the same year Clive despatched a force southward under Colonel Forde, which recaptured Masulipatam from the French, and permanently established British influence throughout the Northern Circars, and at the court of Hyderabad. He next attacked the Dutch, the sole European nation that might yet be a formidable rival to the English. He defeated them both by land and water; and from that time their settlement at Chinsurah existed only on sufferance.

From 1760 to 1765, while Clive was at home, the history of the English in Bengal contains little that is creditable. Clive had left behind him no system of government, but merely the tradition that unlimited sums of money might be extracted from the natives by the mere terror of the English name. In 1761 it was found expedient and profitable to dethrone Mir Jafar, the English nawab of Murshidabad, and substitute his son-in-law, Mir Kasim, in his place. On that occasion, besides private donations, the English received a grant of the three districts of Bardwan, Midnapur, and Chittagong, estimated to yield a net revenue of half a million sterling. But Mir Kasim proved to possess a will of his own, and to cherish dreams of independence. He retired from Murshidabad to Monghyr, a strong position on the Ganges, which commanded the only means of communication with the west. There he proceeded to organize an army, drilled and equipped after European models, and to carry on intrigues with the nawab wazir of Oudh. The actual outbreak

of hostilities with the English happened on this wise: The Company's servants claimed the privilege of carrying on private trade throughout Bengal, free from inland dues and all other imposts. The assertion of this claim caused frequent affrays between the customs' officers of the nawab and those traders, who, whether falsely or not, represented that they were acting on behalf of the servants of the Company. The nawab alleged that his civil authority was everywhere being set at naught. The majority of the council at Calcutta would not listen to his statements. The governor, Mr. Vansittart, and Warren Hastings, then a junior member of council, attempted to effect some compromise. But the controversy had become too hot. The nawab's officers fired upon an English boat, and forthwith all Bengal was in a blaze. A force of 2,000 sepoys was cut to pieces at Patna, and about 200 Englishmen in various parts of the province fell into the hands of the Mahometans, and were subsequently massacred. But as soon as regular warfare commenced Mir Kasim met with no more successes. His trained regiments were defeated in two pitched battles by Major Adams, at Gheriah and at Udha-nala, and he himself took refuge with the nawab wazir of Oudh, who refused to deliver him up. This led to a prolongation of the war. Shah Alam, who had now succeeded his father as emperor, and Shuja-ud-Daula, the nawab wazir of Oudh, united their forces, and threatened Patna, which the English had recovered. A more formidable danger appeared in the English camp, in the form of the first sepoy mutiny. This was quelled by Major (afterward Sir Hector) Munro, who ordered twenty-four of the ringleaders to be blown from guns, an old Mughal punishment. In 1764 Major Munro won the decisive battle of Baxar, which laid Oudh at the feet of the conquerors, and brought the Mughal emperor as a suppliant to the English camp.

Meanwhile the council at Calcutta had twice found the opportunity they desired of selling the government of Bengal to a new nawab. But in 1765 Clive (now Baron Clive of Plassey, in the peerage of Ireland) arrived at Calcutta, as governor of Bengal for the second time, to settle the entire system of relations with the native powers. Two objects stand out conspicuously in his policy. First, he sought to acquire the substance, though not the name, of territorial power, by using the authority of the Mughal emperor for so much as he wished, and for no more; and, secondly, he desired to purify the Company's service by prohibiting illicit gains, and at the same time guaranteeing a reasonable remuneration from honest sources. In neither respect were the details of his plans carried out by his successors. But the beginning of our Indian administration dates from this second governorship of Clive, just as the origin of our Indian empire dates from his victory at Plassey. Clive's first step was to hurry up from Calcutta to Allahabad, and there settle in person the fate of nearly half India. Oudh was given back to the nawab wazir, on condition of his paying £500,000 toward the expenses of the war. The provinces of Allahabad and Kora, forming the greater part of the Doab, were handed over to Shah Alam himself, who in his turn granted to the Company the *diwani* or financial administration of Bengal, Behar, and Orissa, and also the territorial jurisdiction of the Northern Circars. A puppet nawab was still maintained at Murshidabad, who received an annual allowance of about £500,000; and half that amount was paid to the emperor as tribute from Bengal. Thus was constituted the dual system of government, by which the English received all the revenues and undertook to maintain an army for the defense of the frontier, while the criminal jurisdiction vested in the nawab. In Indian phraseology, the Company was *diwan* and the nawab was *nizam*. As a matter of general administration, the actual collection of the revenues still remained for some years in the hands of native officials. In attempting to reorganize and purify the Company's service, Clive undertook a task yet more difficult than to partition the valley of the Ganges. The officers, civil and military alike, were all tainted with the common corruption. Their legal salaries were absolutely insignificant, but they had been permitted to augment them ten and a hundred fold by means of private trade and gifts from the native powers. Despite the united resistance of the civil servants, and an actual mutiny of 200 military officers, Clive carried through his reforms. Both private trade and the receipt of presents were absolutely prohibited for the future, while a substantial increase of pay was provided out of the monopoly of salt.

Lord Clive quitted India for the third and last time in 1767. Between that date and the arrival of Warren Hastings in 1772, nothing of importance occurred in Bengal beyond the terrible famine of 1770, which is officially reported to have swept away one-third of the inhabitants. The dual system of government, however, established by Clive, had proved a failure. Warren Hastings, a tried servant of the Company, distinguished alike for intelligence, for probity, and for knowledge of Oriental manners, was nominated governor by the court of directors, with express instructions to carry out a predetermined series of reforms. In their own words, the court had resolved to "stand forth as diwan, and to take upon themselves, by the agency of their own servants, the entire care and administration of the revenues." In the execution of this plan, Hastings removed the

exchequer from Murshidabad to Calcutta, and for the first time appointed European officers, under the now familiar title of collectors, to superintend the revenue collections and preside in the civil courts. The urgency of foreign affairs, and subsequently internal strife at the council table, hindered Hastings from developing further the system of civil administration, a task finally accomplished by Lord Cornwallis.

Though Hastings always prided himself specially upon that reform, as well as upon the improvements he introduced into the collection of the revenues from salt and opium, his name will be remembered in history for the boldness and success of his foreign policy. From 1772 to 1774 he was governor of Bengal; from 1774 to 1785 he was the first titular governor-general of India, presiding over a council nominated, like himself, not by the Company, but by an Act of Parliament, known as the Regulating Act. In his domestic policy he was greatly hampered by the opposition of Francis; but, so far as regards external relations with Oudh, with the Marhattas, and with Hyder Ali, he was generally able to compel assent to his own measures. His treatment of Oudh may here be passed over as not being material to the general history of India, while the personal aspects of his rule have been fully discussed in a separate article. To explain his Marhatta policy, it will be necessary to give a short retrospective sketch of the history of that people.

Sivaji the Great, as already mentioned, died in 1680, while Aurangzeb was still on the throne. The family of Sivaji produced no great names, either among those who continued to be the nominal chiefs of the Marhatta confederacy, with their capital at Satara, or among the rajahs of Kolhapur and Tanjore. All real power passed into the hands of the peshwa, or Brahman minister, who founded in his turn an hereditary dynasty at Poona, dating from the beginning of the eighteenth century. Next rose several Marhatta generals, who, though recognizing the suzerainty of the peshwa, carved out for themselves independent kingdoms in different parts of India, sometimes far from the original home of the Marhatta race. Chief among these generals were the gaikwar in Guzerat, Sindhia, and Holkar in Malwa, and the Bhonsla rajah of Berar and Nagpur. At one time it seemed probable that the Marhatta confederacy would expel the Mahometans even from northern India; but the decisive battle of Panipat, won by the Afghans in 1761, gave a respite to the Delhi empire. The Marhatta chiefs never again united heartily for a common purpose, though they still continued to be the most formidable military power in India. In especial, they dominated over the British settlement of Bombay on the western coast, which was the last of the three presidencies to feel the lust of territorial ambition. For more than a hundred years, from its acquisition in 1661 to the outbreak of the first Marhatta war in 1775, the English on the west coast possessed no territory outside the island of Bombay and their fortified factory at Surat.

The Bombay Government was naturally emulous to follow the example of Madras and Bengal, and to establish its influence at the court of Poona by placing its own nominee upon the throne. The attempt took form in 1775 in the treaty of Surat, by which Raghunath Rao, one of the claimants to the throne of the peshwa, agreed to cede Salsette and Bassein to the English, in consideration of being himself restored to Poona. The military operations that followed are known as the first Marhatta war. Warren Hastings, who in his capacity of governor-general claimed a right of control over the decisions of the Bombay Government, strongly disapproved of the treaty of Surat, but, when war once broke out, he threw the whole force of the Bengal army into the scale. One of his favorite officers, General Goddard, marched across the peninsula from sea to sea, and conquered the rich province of Guzerat almost without a blow. Another, Captain Popham, stormed the rock-fortress of Gwalior, which was regarded as the key of Hindustan. Those brilliant successes atoned for the disgrace of the convention of Wargaum in 1779, when the Marhattas dictated terms to a British force, but the war was protracted until 1782. It was then closed by the treaty of Salbye, which practically restored the *status quo*. Raghunath Rao, the English claimant, was set aside; Guzerat was restored, and only Salsette and some other small islands were retained by the English.

Meanwhile Warren Hastings had to deal with a more formidable enemy than the Marhatta confederacy. The reckless conduct of the Madras Government had roused the hostility both of Hyder Ali of Mysore and of the nizam of the Deccan, the two strongest Musalman powers in India, who attempted to draw the Marhattas into an alliance against the English. The diplomacy of Hastings won over the nizam and the Marhatta rajah of Nagpur, but the army of Hyder Ali fell like a thunderbolt upon the British possessions in the Carnatic. A strong detachment under Colonel Baillie was cut to pieces at Pollilore, and the Mysore cavalry ravaged the country unchecked up to the walls of Madras. For the second time the Bengal army, stimulated by the energy of Hastings, saved the honor of the English name. Sir Eyre Coote, the victor of Wandewash, was sent by sea to relieve Madras with all the men and money available, while Colonel Pearse marched south overland to overawe the rajah of Berar and the nizam. The war was hotly contested, for Sir Eyre Coote

was now an old man, and the Mysore army was well disciplined and equipped, and also skillfully handled by Hyder and his son Tipu (Tippoo). Hyder died in 1782, and peace was finally concluded with Tipu in 1784, on the basis of a mutual restitution of all conquests.

It was Warren Hastings' merit to organize the empire which Clive founded. He was governor or governor-general for thirteen years, a longer period than any of his successors. During that time the English lost the American colonies, but in India their reputation steadily rose to its highest pitch. Within a year Hastings was succeeded by Lord Cornwallis, the first English nobleman of rank who undertook the office of governor-general. His rule lasted from 1786 to 1793, and is celebrated for two events—the introduction of the Permanent Settlement into Bengal, and the second Mysore war. If the foundations of the system of civil administration were laid by Hastings, the superstructure was erected by Cornwallis. It was he who first intrusted criminal jurisdiction to Europeans, and established the Nizamat Sadr Adalat, or supreme court of criminal judicature, at Calcutta; and it was he who separated the functions of collector and judge. The system thus organized in Bengal was afterward transferred to Madras and Bombay, when those presidencies also acquired territorial sovereignty. But the achievement most familiarly associated with the name of Cornwallis is the permanent settlement of the land revenue of Bengal. Up to his time the revenue had been collected pretty much according to the old Mughal system. *Zamindars*, or government farmers, whose office always tended to become hereditary, were recognized as having a right of some sort to collect the revenue from the actual cultivators. But no principle of assessment existed, and the amount actually realized varied greatly from year to year. Hastings had the reputation of bearing hard upon the *zamindars*, and was absorbed in other critical affairs of state or of war. On the whole he seems to have looked to experience, as acquired from a succession of quinquennial settlements, to furnish the standard rate of the future. Francis, on the other hand, Hastings' great rival, deserves the credit of being among the first to advocate a limitation of the State demand in perpetuity. The same view recommended itself to the authorities at home, partly because it would place their finances on a more stable basis, partly because it seemed to identify the *zamindar* with the more familiar landlord. Accordingly, Cornwallis took out with him in 1787 instructions to introduce a permanent settlement. The process of assessment began in 1789 and terminated in 1791. No attempt was made to measure the fields or calculate the out-turn as had been done by Akbar, and is now done when occasion requires in the British provinces; but the amount payable was fixed by reference to what had been paid in the past. At first the settlement was called decennial, but in 1793 it was declared permanent forever. The total assessment amounted to *sikka* Rs. 26,800,989, or about £2,750,000 sterling. Though Lord Cornwallis carried the scheme into execution, all praise or blame, so far as details are concerned, must belong to Sir John Shore, afterward Lord Teignmouth, whose knowledge of the country was unsurpassed by that of any civilian of his time. Shore would have proceeded more cautiously than Cornwallis' preconceived idea of a proprietary body and the court of directors' haste after fixity permitted.

The second Mysore war of 1790-92 is noteworthy on two accounts: Lord Cornwallis, the governor-general, led the British army in person, with a pomp and lavishness of supplies that recalled the campaigns of Aurangzeb; and the two great native powers, the nizam of the Deccan and the Marhatta confederacy, co-operated as allies of the British. In the result, Tipu Sultan submitted when Lord Cornwallis had commenced to beleaguer his capital. He agreed to yield one-half of his dominions to be divided among the allies, and to pay £3,000,000 toward the cost of the war. Those conditions he fulfilled, but ever afterward he burned to be revenged upon his English conquerors.

The period of Sir John Shore's rule as governor-general, from 1793 to 1798, was uneventful. In 1798 Lord Mornington, better known as the marquis of Wellesley, arrived in India, already inspired with imperial projects that were destined to change the map of the country. Mornington was the friend and favorite of Pitt, from whom he is thought to have derived the comprehensiveness of his political vision and his antipathy to the French name. From the first he laid down as his guiding principle that the English must be the one paramount power in the peninsula, and that native princes could only retain the insignia of sovereignty by surrendering the substance of independence. The subsequent political history of India has been but the gradual development of this policy, which received its finishing touch when Queen Victoria was proclaimed empress of India in 1877.

To frustrate the possibility of a French invasion of India, led by Napoleon in person, was the governing idea of Wellesley's foreign policy; for France at this time, and for many years later, filled the place afterward occupied by Russia in the imagination of English statesmen. Nor was the possibility so remote as might now be thought. French regiments guarded and over-

awed the nizam of Hyderabad. The soldiers of Sindhia, the military head of the Marhatta confederacy, were disciplined and led by French adventurers. Tipu Sultan carried on a secret correspondence with the French directorate, and allowed a tree of liberty to be planted in his dominions. The islands of Mauritius and Bourbon afforded a convenient half-way house both for French intrigue and for the assembling of a hostile expedition. Above all, Napoleon Bonaparte was then in Egypt, dreaming of the conquests of Alexander; and no man knew in what direction he might turn his hitherto unconquered legions. Wellesley first addressed himself to the nizam, where his policy prevailed without serious opposition. The French battalions at Hyderabad were disbanded, and the nizam bound himself by treaty not to take any European into his service without the consent of the English Government—a clause since inserted in every engagement entered into with native powers. Next, the whole weight of Wellesley's resources was turned against Tipu, whom Cornwallis had scotched but not killed. His intrigues with the French were laid bare, and he was given an opportunity of adhering to the new subsidiary system. On his refusal war was declared, and Wellesley came down in state to Madras to organize the expedition in person, and watch over the course of events. One English army marched into Mysore from Madras, accompanied by a contingent from the nizam. Another advanced from the western coast. Tipu, after offering but a feeble resistance in the field, retired into Seringapatam, and, when his capital was stormed, died fighting bravely in the breach. Since the battle of Plassey no event so greatly impressed the native imagination as the capture of Seringapatam, which won for General Harris a peerage, and for Wellesley an Irish marquissate. In dealing with the territories of Tipu, Wellesley acted with unusual moderation. The central portion, forming the old state of Mysore, was restored to an infant representative of the Hindu rajahs, whom Hyder Ali had dethroned, while the rest was partitioned between the nizam, the Marhattas, and the English. At about the same time the province of the Carnatic, or all that large portion of southern India ruled by the nawab of Arcot, and also the principality of Tanjore, were placed under direct British administration, thus constituting the Madras presidency almost as it has existed to the present day.

The Marhattas had been the nominal allies of the English in both their wars with Tipu, but they had never given active assistance, nor were they secured to the English side as the nizam now was. The Marhatta powers at this time were five in number. The recognized head of the confederacy was the peshwa of Poona, who ruled the hill country of the Western Ghats, the cradle of the Marhatta race. The fertile province of Guzerat was annually harried by the horsemen of the gaikwar of Baroda. In Central India two military leaders, Sindhia of Gwalior and Holkar of India, alternately held the pre-eminence. Toward the east the Bhonsla rajah of Nagpur, sprung from the same stock as Savaji, reigned from Berar to the coast of Orissa. Wellesley tried assiduously to bring these several Marhatta powers within the net of his subsidiary system. At last, in 1802, the necessities of the peshwa, who had been defeated by Holkar, and driven as a fugitive into British territory, induced him to sign the treaty of Bassein, by which he pledged himself to hold communications with no other power, European or native, and ceded territory for the maintenance of a subsidiary force. This greatly extended the English territorial influence in the Bombay presidency, but led directly to the second Marhatta war, for neither Sindhia nor the rajah of Nagpur would tolerate this abandonment of Marhatta independence. The campaigns that followed are perhaps the most glorious in the history of the British arms in India. The general plan and the adequate provision of resources were due to the marquis of Wellesley, as also the indomitable spirit that could not anticipate defeat. The armies were led by Sir Arthur Wellesley (afterward duke of Wellington) and General (afterward Lord) Lake. Wellesley operated in the Deccan, where, in a few short months, he won the decisive victories of Assaye and Argaum, and captured Ahmadnagar. Lake's campaign in Hindustan was no less brilliant, though it has received less notice from historians. He won pitched battles at Aligarh and Laswari, and captured the cities of Delhi and Agra, thus scattering the French troops of Sindhia, and at the same time coming forward as the champion of the Mughal emperor in his hereditary capitals. Before the year 1803 was out, both Sindhia and the Bhonsla rajah were glad to sue for peace. Sindhia ceded all claims to the territory north of the Jumna, and left the blind old emperor Shah Alam once more under British protection. The Bhonsla forfeited Orissa to the English, who had already occupied it with a flying column, and Berar to the nizam, who gained a fresh addition by every act of complaisance to the British Government. The freebooter, Jaswant Rao Holkar, alone remained in the field, supporting his troops by ravages through Malwa and Rajputana. The concluding years of Wellesley's rule were occupied with a series of operations against Holkar, which brought no credit on the British name. The disastrous retreat of Colonel Monson through Central India recalled memories of the convention of Wargaum, and of the destruction of Colonel Baillie's force

by Hyder Ali. The repulse of Lake in person at the siege of Bhartpur (Bhurtপুর) is memorable as an instance of a British army in India having to turn back with its object unaccomplished.

The ambitious policy and the continuous wars of Lord Wellesley exhausted the patience of the court of directors at home. In 1804 Lord Cornwallis was sent out as governor-general a second time, with instructions to bring about peace at any price, while Holkar was still unsubdued, and Sindhia was threatening a fresh war. But Cornwallis was now an old man and broken down in health. Traveling up to the northwest during the rainy season, he sank and died at Ghazipur, before he had been ten weeks in the country. His immediate successor was Sir George Barlow, a civil servant of the Company, who, as a *locum tenens*, had no alternative but to carry out faithfully the orders of his employers. He is charged with being, under these orders, the only governor-general who diminished the area of British territory, and with violating engagements by abandoning the Rajput chiefs to the tender mercies of Holkar and Sindhia. During his administration also occurred the mutiny of the Madras sepoys at Vellore, which, though promptly suppressed, sent a shock of insecurity throughout the empire.

Lord Minto, governor-general from 1807 to 1813, consolidated the conquests which Wellesley had acquired. His only military exploits were the occupation of the island of Mauritius, and the conquest of Java by an expedition which he accompanied in person. The condition of Central India continued to be disturbed, but Minto succeeded in preventing any violent outbreaks without himself having recourse to the sword. The Company had ordered him to follow a policy of non-intervention, and he managed to obey his orders without injuring the prestige of the British name. In his time the Indian Government first opened relations with a new set of foreign powers, by sending embassies to the Punjab, to Afghanistan, and to Persia. The ambassadors were all trained in the school of Wellesley, and formed perhaps the most illustrious trio of "politicals" that the Indian service has produced. Metcalfe was the envoy to the court of Ranjit Singh at Lahore; Elphinstone met the shah of Afghanistan at Peshawar; and Malcolm was dispatched to Persia. If it cannot be said that any of these missions were fruitful in permanent results, at least they introduced the English to a new set of diplomatic relations, and widened the sphere of their influence.

The successor of Lord Minto was Lord Moira, better known as the marquis of Hastings, who governed India for the long period of nine years, from 1814 to 1823. This period was marked by two wars of the first magnitude, the campaigns against the Gurkhas (Goorkhas) of Nepal, and the third and last Marhatta war. The Gurkhas, the present ruling race in Nepal, are Hindu immigrants who claim a Rajput origin. The indigenous inhabitants, called Newars, belong to the Indo-Tibetan stock, and profess Buddhism. The sovereignty of the Gurkhas dates only from 1767, in which year they overran the valley of Khatmandu, and gradually extended their power over all the hills and valleys of Nepal. Organized upon a sort of military and feudal basis, they soon became a terror to all their neighbors, marching east into Sikkim, west into Kumaun, and south into the Gangetic plains. In the last quarter their victims were British subjects, and at last it became imperatively necessary to check their advance. Sir George Barlow and Lord Minto had remonstrated in vain, and nothing was left to Lord Moira but to take up arms. The campaign of 1814 was little short of disastrous. After overcoming the natural difficulties of a malarious climate and precipitous hills, the sepoys were on several occasions fairly worsted by the unexpected bravery of the little Gurkhas, whose heavy knives or *kukris* dealt terrible execution. But in 1815 General Ochterlony, who commanded the army operating by way of the Sutlej, stormed one by one the hill forts which still stud the Himalayan states, now under the Punjab government, and compelled the Nepal *darbar* to sue for peace. In the following year the same general advanced from Patna into the valley of Khatmandu, and finally dictated the terms which had before been rejected, within a few miles of the capital. By the treaty of Segauli, which defines the English relations with Nepal to the present day, the Gurkhas withdrew on the one hand from Sikkim, and on the other from those lower ranges of the western Himalayas which have supplied the health-giving stations of Naini Tal, Massuri, and Simla. Meanwhile the condition of Central India was every year becoming more unsatisfactory. Though the great Marhatta chiefs were learning to live rather as peaceful princes than as leaders of predatory bands, the example of lawlessness they had set was being followed, and bettered in the following, by a new set of freebooters, known as the Pindharis. As opposed to the Marhattas, who were at least a nationality bound by some traditions of a united government, the Pindharis were merely irregular soldiers, corresponding most nearly to the free companies of mediæval Europe. Of no common race and of no common religion, they welcomed to their ranks the outlaws and broken tribes of all India—Afghans, Marhattas, or Jats. Their headquarters were in Malwa, but their depredations were not confined to Central India. In bands sometimes numbering a few hundreds, sometimes many

thousands, they rode out on their forays as far as Malabar and the Coromandel coast. The most powerful of the Pindhari captains, Amir Khan, had an organized army of many regiments, and several batteries of cannon. Two other leaders, known as Chitu and Karim, at one time paid a ransom to Sindhia of £100,000. To suppress the Pindhari hordes, who were supported by the sympathy, more or less open, of all the Marhatta chiefs, Lord Hastings (1817) collected the strongest British army that had been seen in India, numbering nearly 120,000 men, half to operate from the north, half from the south. Sindhia was overawed, and remained quiet. Amir Khan consented to disband his army, on condition of being guaranteed the possession of what is now the principality of Tank. The remaining bodies of Pindharies were attacked in their homes, surrounded, and cut to pieces. Karim threw himself upon the mercy of the conquerors. Chitu fled to the jungles, and was killed by a tiger. In the same year (1817) as that in which the Pindharies were crushed, and almost in the same month (November), the three great Marhatta powers at Poona, Nagpur, and Indore rose against the English. The peshwa, Baji Rao, had long been chafing under the terms imposed by the treaty of Bassein (1802), and the subsequent treaty of Poona (1817), which riveted yet closer the chains of dependence upon the paramount power. Elphinstone, then resident at his court, foresaw what was coming and withdrew to Kirkee, whither he had ordered up a European regiment. The next day the residency was burned down, and Kirkee was attacked by the whole army of the peshwa. The attack was bravely repulsed, and the peshwa immediately fled from his capital. Almost the same plot was enacted at Nagpur, where the honor of the British name was saved by the sepoys, who defended the hill of Sitabaldi against enormous odds. The army of Holkar was defeated in the following month at the pitched battle of Mehidpur. All open resistance was now at an end. Nothing remained but to follow up the fugitives, and determine the conditions of the general pacification. In both these duties Sir John Malcolm played a prominent part. The dominions of the peshwa were annexed to the Bombay presidency, and the nucleus of the present Central Provinces was formed out of the territory saved from the Pindharies. The peshwa himself surrendered, and was permitted to reside at Bithur, near Cawnpur, on a pension of £80,000 a year. His adopted son was the infamous Nana Sahib. To fill the peshwa's place to some extent at the head of the Marhatta confederacy, the lineal descendant of Sivaji was brought forth from obscurity, and placed upon the throne of Satara. An infant was recognized as the heir of Holkar, and a second infant was proclaimed rajah of Nagpur under British guardianship. At the same time the several states of Rajputana accepted the position of feudatories of the paramount power. The map of India, as thus drawn by Lord Hastings, remained substantially unchanged until the time of Lord Dalhousie. But the proudest boast of Lord Hastings and Sir John Malcolm was, not that they had advanced the *pomerium*, but that they had conferred the blessings of peace and good government upon millions who had suffered unutterable things from Marhatta and Pindhari tyranny.

The marquis of Hastings was succeeded by Lord Amherst, after the interval of a few months, during which Mr. Adam, a civil servant, acted as governor-general. Lord Amherst's administration lasted for five years, from 1823 to 1828. It is known in history by two prominent events, the first Burmese war and the capture of Bhartpur. For some years past the north-east frontier had been disturbed by the restlessness of the Burmese. The country that fringes the western shore of the Bay of Bengal and runs up the valley of the Irawadi, with a people of Tibeto-Chinese origin, has a history of its own, parallel to, but not altogether independent of, that of India. Tradition asserts that its early civilization was introduced from the opposite coast of Coromandel, by a people who still preserve a trace of their origin in their name of Talaing (*cf.* Telinga and Telugu). However this may be, the Buddhist religion, professed by the Burmese at the present day, certainly came direct from India at a very early date. Many waves of invasion from Siam in the south and from the wild mountains in the north have passed over the land. These conquests were marked by that wanton and wholesale barbarity which seems to characterize the Tibeto-Chinese race, but the civilization of Buddhism survived every shock, and flourished around the ancient pagodas. European travelers in the fifteenth century visited Pegu and Tenasserim, which they describe as flourishing marts of maritime trade. During the period of Portuguese predominance in the East, Arakan became the resort of loose European adventurers. With their help the Arakanese extended their power inland, occupied Chittagong, and (under the name of the Maghs) became the terror of the entire delta of the Ganges. About 1750 a new dynasty arose, founded by Alaungphaya or Alompra, with its capital at Ava, which still rules over Independent Burmah. The successors of Alompra, after having subjugated all Burmah, and overrun Assam, which was then an independent kingdom, began a series of encroachments upon British territory in India. As all peaceful proposals were contumeliously rejected, Lord Amherst was compelled to declare war in 1824. Little military

glory could be gained by beating the Burmese, who were formidable only from the pestilential character of their country. One expedition with gunboats proceeded up the Brahmaputra into Assam; another marched by land through Chittagong into Arakan, for the Bengal sepoys refused to go by sea; a third, and the strongest, sailed from Madras direct to the mouth of the Irawadi. The war was protracted over two years. At last, after the loss of about 20,000 lives and an expenditure of £14,000,000, the king of Ava consented to sign the treaty of Yandabu, by which he abandoned all claim to Assam, and ceded the provinces of Arakan and Tenasserim, which were already in the military occupation of the British. He retained all the valley of the Irawadi, down to the sea at Rangoon. The capture of Bhartpur in Central India by Lord Combermere, in 1827, wiped out the repulse which Lake had received before that city in January, 1805. A disputed succession necessitated British intervention. Artillery could make little impression upon the massive walls of mud, but at last a breach was effected by mining, and the city was taken by storm, thus losing its general reputation throughout India for impregnability, which had threatened to become a political danger.

The next governor-general was Lord William Bentinck, who had been governor of Madras twenty years earlier at the time of the mutiny of Vellore. His seven years' rule (from 1828 to 1835) is not signalized by any of those victories or extensions of territory by which chroniclers delight to measure the growth of empire. But it forms an epoch in administrative reform, and in the slow process by which the hearts of a subject population are won over to venerate as well as dread their alien rulers. The modern history of the British in India, as benevolent administrators ruling the country with a single eye to the good of the natives, may be said to begin with Lord William Bentinck. According to the inscription upon his statue at Calcutta, from the pen of Macaulay, "He abolished cruel rites; he effaced humiliating distinctions; he gave liberty to the expression of public opinion; his constant study it was to elevate the intellectual and moral character of the nations committed to his charge." His first care on arrival in India was to restore equilibrium to the finances, which were tottering under the burden imposed upon them by the Burmese war. This he effected by reductions in permanent expenditure, amounting in the aggregate to £1,500,000, as well as by augmenting the revenue from land that had escaped assessment and from the opium of Malwa. He also widened the gates by which educated natives could enter the service of the Company. Some of these reforms were distasteful to the covenanted service and to the officers of the army, but Lord William was always staunchly supported by the court of directors and by the Whig ministry at home.

His two most memorable acts are the abolition of *sati* (suttee) and the suppression of the *Thags* (Thugs). At this distance of time it is difficult to realize the degree to which these two barbarous practices had corrupted the social system of the Hindus. European research has clearly proved that the text in the *Vedas* adduced to authorize the immolation of widows was a willful mistranslation. But the practice had been ingrained in Hindu opinion by the authority of centuries, and had acquired the sanctity of a religious rite. The emperor Akbar is said to have prohibited it by law, but the early English rulers did not dare so far to violate the traditions of religious toleration. In the year 1817 no less than 700 widows are said to have been burned alive in the Bengal presidency alone. To this day the most holy spots of Hindu pilgrimage are thickly dotted with little white pillars, each commemorating a *sati*. In the teeth of strenuous opposition, both from Europeans and natives, Lord William carried the regulation in council on December 4, 1829, by which all who abetted *sati* were declared guilty of "culpable homicide." The honor of suppressing *Thagi* must be shared between Lord William and Captain Sleeman. *Thagi* was an abnormal excrescence upon Hinduism, in so far as the bands of secret assassins were sworn together by an oath based on the rites of the bloody goddess Kali. Between 1826 and 1835 as many as 1,562 Thags were apprehended in different parts of British India, and by the evidence of approvers the moral plague spot was gradually stamped out.

Two other historical events are connected with the administration of Lord William Bentinck. In 1833 the charter of the East India Company was renewed for twenty years, but only upon the terms that it should abandon its trade and permit Europeans to settle freely in the country. At the same time a legal or fourth member was added to the governor-general's council, who might not be a servant of the Company, and a commission was appointed to revise and codify the law. Macaulay was the first legal member of council, and the first president of the law commission. In 1830 it was found necessary to take the state of Mysore under British administration, where it continued to the year 1881, being then restored to its native ruler, under British protection, and in 1834 the frantic misrule of the rajah of Coorg brought on a short and sharp war. The rajah was permitted to retire to Benares, and the brave and proud inhabitants of that mountainous little territory decided to place themselves under the rule of the Company; so that the only an

nexation effected by Lord William Bentinck was "in consideration of the unanimous wish of the people."

Sir Charles (afterward Lord) Metcalfe succeeded Lord William as senior member of council. His short term of office is memorable for the measure which his predecessor had initiated, but which he willingly carried into execution, for giving entire liberty to the press. Public opinion in India, as well as the express wish of the court of directors at home, pointed to Metcalfe as the most fit person to carry out the policy of Bentinck, not provisionally, but as governor-general for a full term. Party exigencies, however, led to the appointment of Lord Auckland. From that date commences a new era of war and conquest, which may be said to have lasted for twenty years. All looked peaceful until Lord Auckland, prompted by his evil genius, attempted to place Shah Shuja upon the throne of Cabul, an attempt which ended in the gross mismanagement and annihilation of the garrison placed in that city. The disaster in Afghanistan was quickly followed by the conquest of Sind, the two wars in the Punjab, the second Burmese war, and last of all the Mutiny. Names like Gough and Napier and Colin Campbell take the places of Malcolm and Metcalfe and Elphinstone.

For the first time since the days of the sultans of Ghazni and Ghor, Afghanistan had obtained a national king in 1747 in the person of the Ahmad Shah Durani, who found his opportunity in the confusion that followed on the death of the Persian conqueror, Nadir Shah. Before his death in 1773 Ahmad Shah had conquered a wide empire, from Herat to Peshawar and from Kashmir to Sind. His intervention on the field of Panipat (1761) turned back the tide of Marhatta conquest, and replaced a Mughal emperor on the throne of Delhi. But Ahmad Shah never cared to settle down in India, and kept alternate state at his two national capitals of Cabul and Kandahar. The Durani kings were prolific in children, who fought to the death with one another for the succession. At last, in 1826, Dost Muhammad, head of the powerful Barakzai family, succeeded in establishing himself as ruler of Cabul, with the subordinate title of amir (ameer), while two fugitive brothers of the Durani line were living under British protection at Ludhiana, on the frontier of the Punjab.

The attention of the English Government had been directed to Afghan affairs ever since the time of Lord Wellesley, who feared that Zaman Shah, then holding his court at Lahore, might follow in the path of Nadir Shah, and overrun Hindustan. The growth of the powerful Sikh kingdom of Ranjit Singh effectually dispelled any such alarms for the future. Subsequently, in 1809, while a French invasion of India was still a possibility to be guarded against, Elphinstone was sent by Lord Minto on a mission to Shah Shuja to form a defensive alliance. Before the year was out, Shah Shuja had been driven into exile, and a third brother, Mahmud Shah, was on the throne. In 1837, when the curtain rises upon the drama of English interference in Afghanistan, the usurper Dost Muhammad Barakzai was firmly established at Cabul. His great ambition was to recover Peshawar from the Sikhs; and when Captain Alexander Burnes arrived on a mission from Lord Auckland, with the ostensible object of opening trade, the Dost was willing to promise everything, if only he could get Peshawar. But Lord Auckland had another and more important object in view. At this time the Russians were advancing rapidly in Central Asia, and a Persian army, not without Russian support, was besieging Herat, the traditional bulwark of Afghanistan on the east. A Russian envoy was at Cabul at the same time as Burnes. The latter was unable to satisfy the demands of Dost Muhammad in the matter of Peshawar, and returned to India unsuccessful. Lord Auckland forthwith resolved upon the hazardous plan of placing a more subservient ruler upon the throne of Cabul. Shah Shuja, one of the two exiles at Ludhiana, was selected for the purpose. At this time both the Punjab and Sind were independent kingdoms. Sind was the less powerful of the two, and therefore a British army, escorting Shah Shujah, made its way by that route to enter Afghanistan through the Bolan Pass. Kandahar surrendered, Ghazni was taken by storm, Dost Muhammad fled across the Hindu Kush, and Shah Shuja was triumphantly led into the Bala Hissar at Cabul in August, 1839. During the two years that followed, Afghanistan remained in the military occupation of the British. The catastrophe occurred in November, 1841, when Sir Alexander Burnes was assassinated in the city of Cabul. The troops in the cantonments were then under command of General Elphinstone (not to be confounded with the civilian Mountstuart Elphinstone), with Sir William Macnaghten as chief political adviser. Elphinstone was an old man, unequal to the responsibilities of the position. Macnaghten was treacherously murdered at an interview with the Afghan chief, Akbar Khan, eldest son of Dost Muhammad. After lingering in their cantonments for two months, the British army set off in the depth of winter to find its way back to India through the passes. When they started they numbered 4,000 fighting men, with 12,000 camp followers. A single survivor, Doctor Brydon, reached the friendly walls of Jalalabad, where Sale was gallantly holding out. The rest perished in the defiles of Khurd, Cabul, and Jagdalak, either from the knives

and matchlocks of the Afghans, or from the effects of cold. A few prisoners, mostly women, children, and officers, were considerately treated by the orders of Akbar Khan.

Within a month after the news reached Calcutta, Lord Auckland had been superseded by Lord Ellenborough, whose first impulse was to be satisfied with drawing off in safety the garrisons from Kandahar and Jalalabad. But bolder counsels prevailed. Pollock, who was marching straight through the Punjab to relieve Sale, was ordered to penetrate to Cabul, while Nott was only too glad not to be forbidden to retire from Kandahar through Cabul. After a good deal of fighting, the two English forces met at their common destination in September, 1842. The great bazaar at Cabul was blown up with gunpowder, to fix a stigma upon the city; the prisoners were recovered, and all marched back to India, leaving Dost Muhammad to take undisputed possession of his throne. The drama closed with a bombastic proclamation from Lord Ellenborough, who had caused the gates from the tomb of Mahmud of Ghazni to be carried back as a memorial of "Somnath revenged."

Lord Ellenborough, who loved military display, had his tastes gratified by two more wars. In 1843 the Mahometan rulers of Sind, known as the "meers" or amirs, whose only fault was that they would not surrender their independence, were crushed by Sir Charles Napier. The victory of Miani, in which 3,000 British troops defeated 20,000 Baluchis, is perhaps the most brilliant feat of arms in Indian history; but an honest excuse can scarcely be found for the annexation of the country. In the same year a disputed succession at Gwalior, fomented by feminine intrigue, resulted in an outbreak of the overgrown army which the Sindhia family had been allowed to maintain. Peace was restored by the battles of Maharajpur and Punneah, at the former of which Lord Ellenborough was present in person.

In 1844 Lord Ellenborough was recalled by the court of directors, who differed from him on many points of administration, and distrusted his erratic genius. He was succeeded by Sir Henry (afterward Lord) Hardinge, who had served through the Peninsular War and had lost a hand at Ligny. It was felt on all sides that a trial of strength between the British and the Sikhs was at hand.

The Sikhs were not a nationality like the Marhattas, but a religious sect bound together by the additional tie of military discipline. They trace their origin to one Nanak, an excellent and successful preacher, who was born in the neighborhood of Lahore in the latter half of the fifteenth century, before the arrival of either Mughals or Portuguese in India. Nanak was a religious reformer, like others that arose in the country about that time, who preached the abolition of caste, the unity of the Godhead, and the obligation of leading a pure life. From Nanak ten *gurus* or apostles are traced down to Govind Singh in 1708, with whom the succession stopped. Suffering continual persecution from the ruling Mahometans, which culminated in the reign of Aurangzeb, the Sikh religion maintained itself with extraordinary tenacity. At last the downfall of the Mughal empire transformed it into a territorial power, which possessed the only organization remaining in the Punjab. Even before the rise of Ranjit Singh, offshoots from the Sikh *misl*s or confederacies, each led by its elected *sardar*, had carved out for themselves feudal principalities along the banks of the Sutlej, some of which have endured to the present day. Banjit Singh, the founder of the Sikh kingdom, was born in 1780. In his twentieth year he obtained the appointment of governor of Lahore from the Afghan emperor, and from that time he set himself to the task of basing a personal despotism upon the religious fanaticism of the Sikhs. The *khalsa* or "the liberated" were organized into an army under European officers, which for steadiness and religious fervor has had no parallel since the "Ironsides" of Cromwell. From Lahore as his capital he extended his conquests south to Multan, west to Peshawar, and north to Kashmir. On the east side alone he was hemmed in by the Sutlej, up to which river the authority of the British Government was advanced in 1804. Till his death in 1839 Ranjit Singh was ever loyal to the engagements which he had entered into with Metcalfe in 1809. But he left no son capable of wielding his scepter. Lahore was torn by dissensions between rival generals, ministers, and queens. The only strong power was the army of the *khalsa*, which since the disaster in Afghanistan burned to measure its strength with the British sepoys. The French generals, Avitabile and Court, were foolishly ousted, and the supreme military command was vested in a series of *panchayats* or elective committees of five.

In 1845 the Sikh army, numbering 60,000 men with 150 guns, crossed the Sutlej and invaded British territory. Sir Hugh Gough, the commander-in-chief, together with the governor-general, hurried up to the frontier. Within three weeks four pitched battles were fought, at Moodkee, Ferozshah, Aliwal, and Sohraon. The British loss on each occasion was heavy; but by the last victory the Sikhs were fairly driven into and across the Sutlej, and Lahore surrendered to the British. By the terms of peace then dictated the infant son of Ranjit, Dhulip Singh, was recognized as rajah; the Jalandhar Doab, or tract between the Sutlej and the Ravi, was annexed; the Sikh army was limited to a specified number; Major Henry Lawrence was appointed to

be resident at Lahore; and a British force was detailed to garrison the Punjab for a period of eight years. Sir H. Hardinge received a peerage, and returned to England in 1848.

Lord Dalhousie succeeded, whose eight years' administration (from 1848 to 1856) was more pregnant of results than that of any governor-general since Clive. Though professedly a man of peace, he was compelled to fight two wars, in the Punjab and in Burmah. These both ended in large acquisitions of territory, while Nagpur, Oudh, and several minor states also came under British rule. But Dalhousie's own special interest lay in the advancement of the moral and material condition of the country. The system of administration carried out in the conquered Punjab by the two Lawrences and their assistants is probably the most successful piece of difficult work ever accomplished by Englishmen. British Burmah has prospered under their rule scarcely less than the Punjab. In both cases Lord Dalhousie deserves a large share of the credit. No branch of the administration escaped his reforming hand. He founded the public works department, to pay special attention to roads and canals. He opened the Ganges Canal, still the largest work of the kind in the country, and he turned the sod of the first Indian railway. He promoted steam communication with England *via* the Red Sea, and introduced cheap postage and the electric telegraph. It is Lord Dalhousie's misfortune that these benefits are too often forgotten in the vivid recollections of the Mutiny, which avenged his policy of annexation.

Lord Dalhousie had not been six months in India before the second Sikh war broke out. Two British officers were treacherously assassinated at Multan. Unfortunately Henry Lawrence was at home on sick leave. The British army was not ready to act in the hot weather, and, despite the single-handed exertions of Lieutenant (afterward Sir Herbert) Edwardes, this outbreak of fanaticism led to a general rising. The *khalsa* army again came together, and once more fought on even terms with the British. On the fatal field of Chillianwala, which patriotism prefers to call a drawn battle, the British lost 2,400 officers and men, besides four guns and the colors of three regiments. Before re-enforcements could come out from England, with Sir Charles Napier as commander-in-chief, Lord Gough had restored his own reputation by the crowning victory of Guzerat, which absolutely destroyed the Sikh army. Multan had previously fallen; and the Afghan horse under Dost Muhammad, who had forgotten their hereditary antipathy to the Sikhs in their greater hatred of the British name, were chased back with ignominy, to their native hills. The Punjab henceforth became a British province, supplying a virgin field for the administrative talents of Dalhousie and the two Lawrences. Rajah Dhulip Singh received an allowance of £50,000 a year, on which he retired as a country gentleman to Norfolk in England. The first step in the pacification of the Punjab was a general disarmament, which resulted in the delivery of no less than 120,000 weapons of various kinds. Then followed a settlement of the land tax, village by village, at an assessment much below that to which it had been raised by Sikh exactions, and the introduction of a loose but equitable code of civil and criminal procedure. Roads and canals were laid out by Colonel Robert Napier (afterward Lord Napier of Magdala); and the security of British peace and the personal influence of British officers were felt to the furthest corners of the province. Thus it happened that, when the Mutiny broke out in 1857, the Punjab remained not only quiet but loyal, after only eight years' experience of English rule; while the Northwestern Provinces, which had been British territory for more than half a century, rose in rebellion. The second Burmese war of 1852 was caused by the ill-treatment of European merchants at Rangoon, and the insolence offered to the captain of a frigate who had been sent to remonstrate. The whole valley of the Irawadi, from Rangoon to Prome, was occupied in a few months, and, as the king of Ava refused to treat, it was annexed, under the name of Pegu, to the provinces of Arakan and Tenasserim, which had been acquired in 1826. Since annexation the inhabitants of Rangoon have increased tenfold in number, and that port now ranks third in British India, being surpassed only by Calcutta and Madras. Lord Dalhousie's dealings with the feudatory states of India can only be rightly appreciated as part of his general policy. That rulers only exist for the good of the ruled was his supreme axiom of government, of which he gave the most conspicuous example by the practice of his own daily life. That British administration was better for the people than native rule followed from this axiom as a necessary corollary. He was thus led to regard native chiefs from somewhat the same point of view as the Scotch regarded the hereditary jurisdictions after 1745, as mischievous anomalies, to be abolished by every means practicable. Good faith must be kept with rulers on the throne and with their legitimate heirs, but no false sentiment should preserve dynasties that had forfeited all consideration by years of accumulated misrule, or prolong those that had no natural successor. The "doctrine of lapse" was merely a special application of these principles, though complicated by the theory of adoption. It has never been doubted that, according to Hindu private law, an adopted son entirely fills the place of a natural son, whether to perform the religious

obsequies of his father or to inherit his property. In all respects he continues the *persona* of the deceased. But it was argued that the succession to a throne stood upon a different footing. The paramount power could not recognize such a right, which might be used as a fraud to hand over the happiness of millions to a base-born imposter. Here came in the maxim of "the good of the governed." The material benefits to be conferred through British administration surely weighed heavier in the scale than a superstitious and frequently fraudulent fiction of inheritance. The first state to escheat to the British Government in accordance with these principles was Satara, which had been reconstituted by Lord Hastings on the downfall of the peshwa in 1818. The last direct representative of Sivaji died without a male heir in 1848, and his deathbed adoption was set aside. In the same year the Rajput state of Karauli was saved by the interposition of the court of directors, who drew a fine distinction between a dependent principality and a protected ally. In 1833 Jhansi suffered the same fate as Satara. But the most conspicuous application of the doctrine of lapse was the case of Nagpur. The last of the Bhonslas, a dynasty older than the British Government itself, died without a son, natural or adopted, in 1853. That year also saw British administration extended to the Berars, or the assigned districts which the nizam of Hyderabad was induced to cede as a territorial guarantee for the subsidies which he perpetually kept in arrear. Three more distinguished names likewise passed away in 1853, though without any attendant accretion to British territory. In the extreme south the titular nawab of the Carnatic and the titular rajan of Fanjore both died without heirs. Their rank and their pensions died with them, though compassionate allowances were continued to their families. In the north of India, Baji Rao, the ex-peshwa who had been dethroned in 1818, lived on till 1853 in the enjoyment of his annual pension of £80,000. His adopted son, Nana Sahib, inherited his accumulated savings, but could obtain no further recognition.

The annexation of the province of Oudh is to be defended on very different grounds. Ever since the nawab wazir, Shuja-ud-Daula, received back his forfeited territories from the hands of Lord Clive in 1765, the very existence of Oudh as an independent state had depended only upon the protection of British bayonets. Thus, preserved alike from foreign invasion and from domestic rebellion, the long line of subsequent nawabs had given way to that neglect of public affairs and those private vices which naturally flow from irresponsible power. Their only redeeming virtue was steady loyalty to the British Government. Oudh has been called "the Garden of India" by an author who endeavors to show that the evils of native rule were never so black as they have been painted. But at any rate that fair corner of the Gangetic basin, which now supports a denser population than any equal area on the surface of the globe, had been groaning for generations under anarchy, for which each successive governor-general admitted that he was partly responsible. Warning after warning had been given to the nawabs (who had assumed the title of shah or king since 1819) that they must put their house in order. What the benevolent Bentinck and the soldierly Hardinge had only threatened was reserved for Lord Dalhousie, who united honesty of purpose with decision of character. In this determination he had the full support of the court of directors at home. In 1856, the last year of his rule, he issued orders to General (afterward Sir James) Outram, then resident at the court of Lucknow, to assume the direct administration of Oudh, on the ground that "the British Government would be guilty in the sight of God and man, if it were any longer to aid in sustaining by its countenance an administration fraught with suffering to millions." The king, Wajid Ali, bowed to irresistible force, though he ever refused to recognize the justice of his deposition. After a mission to England, by way of protest and appeal, he settled down in the pleasant suburb of Garden Reach, near Calcutta, where he lived in the enjoyment of a pension of £120,000 a year. Oudh was thus annexed without a blow; but it may be doubted whether the one measure of Lord Dalhousie, upon which he looked back himself with the clearest conscience, was not the very one that most alarmed native public opinion.

The marquis of Dalhousie resigned office in March, 1856, being then only forty-four years of age; but he carried home with him the seeds of a lingering illness which resulted in his death in 1860. Excepting Cornwallis, he was the first, though by no means the last, of English statesmen who have fallen victims to their devotion to India's needs. He was succeeded by his friend, Lord Canning, who, at the farewell banquet in England given to him by the court of directors, uttered these prophetic words: "I wish for a peaceful term of office. But I cannot forget that in the sky of India, serene as it is, a small cloud may arise, no larger than a man's hand, but which, growing larger and larger, may at last threaten to burst and overwhelm us with ruin." In the following year the sepoys of the Bengal army mutinied, and all the valley of the Ganges from Patna to Delhi rose in open rebellion.

The various motives assigned for the Mutiny appear inadequate to the European mind. The truth seems to be that native opinion throughout India was in a ferment, predisposing men to

believe the wildest stories, and to act precipitately upon their fears. The influence of panic in an Oriental population is greater than might be readily believed. In the first place, the policy of Lord Dalhousie, exactly in proportion as it had been dictated by the most honorable considerations, was utterly distasteful to the native mind. Repeated annexations, the spread of education, the appearance of the steam engine and the telegraph wire, all alike revealed a consistent determination to substitute an English for an Indian civilization. The Bengal sepoys, especially, thought that they could see into the future farther than the rest of their countrymen. Nearly all men of high caste, and many of them recruited from Oudh, they dreaded tendencies which they deemed to be denationalizing, and they knew at first hand what annexation meant. They believed it was by their prowess that the Punjab had been conquered, and all India was held quiet. The numerous dethroned princes, their heirs and their widows, were the first to learn and take advantage of the spirit of disaffection that was abroad. They had heard of the Crimean war, and were told that Russia was the perpetual enemy of England. They had money in abundance with which they could buy the assistance of skillful intriguers. They had everything to gain, and nothing to lose, by a revolution.

In this critical state of affairs, of which the government had no official knowledge, a rumor ran through the cantonments of the Bengal army that cartridges had been served out greased with the fat of animals unclean alike to Hindu and Mahometan. After this, nothing could quiet the minds of the sepoys. Fires occurred nightly in the native lines; officers were insulted by their men; all confidence was gone, and only the form of discipline remained. On the afternoon of Sunday, May 10, 1857, the sepoys at Meerut (Mirath) broke into open mutiny. Their first mad frenzy marked by its excess the change from their usually quiet manners and orderly habits. They broke into the jail, and then ran through the cantonments, cutting down every European they met. At last they streamed off to the neighboring city of Delhi, to stir up the native garrison and the criminal population of that great city, and to place themselves under the authority of the disrowned Mughal emperor. Meerut was the largest military station in India, with a strong European garrison of foot, horse, and guns, sufficient to overwhelm the mutineers before ever they reached Delhi. But just as the sepoys acted in irrational panic, so did British officers in but too many cases act with equally irrational indecision. The news of the outbreak was telegraphed to Delhi, and nothing more was done that night. The next morning the Mahometans of Delhi rose, and all that the Europeans there could do was to blow up the magazine. A rallying center and a traditional name was thus given to the revolt, which forthwith spread like wildfire through all the North-western Provinces and Oudh down into Lower Bengal. The same narrative must suffice for all, though each episode has its own peculiar story of sadness and devotion. The sepoys rose on their officers, without warning, and sometimes after protestations of fidelity. The Europeans, or persons of Christian faith, were massacred, sometimes also women and children. The jail was broken open, the treasure plundered, and then all marched off to some center of revolt, to join in what had now become a national war. Only in the Punjab were the sepoys anticipated by the stern measures of repression and disarmament adopted by Sir John Lawrence and his lieutenants, among whom Edwardes and Nicholson were conspicuous. The Sikh population never wavered. Crowds of willing recruits came down from the Afghan hills. And thus the Punjab, instead of being itself a source of danger, was able to furnish a portion of its own garrison for the siege of Delhi. In Lower Bengal most of the sepoys mutinied, and then dispersed in different directions. The native armies of Madras and Bombay remained true to their colors. In Central India the contingents of many of the great chiefs sooner or later joined the rebels, but the Mahometan state of Hyderabad was kept loyal by the authority of its able minister, Sir Salar Jang.

The main interest of the sepoy war gathers around the three cities of Cawnpur, Lucknow, and Delhi. The cantonments at Cawnpur contained the largest native garrison in India; and in the immediate neighborhood, at Bithur, was the palace of Dandhu Panth, the disinherited heir of the last peshwa, whose more familiar appellation of Nana Sahib will ever be handed down to the infamy of history. At first the Nana was profuse in his professions of loyalty, but as soon as the sepoys mutinied he put himself at their head, and was proclaimed peshwa of the Marhattas. The Europeans at Cawnpur, who numbered more women and children than fighting men, shut themselves up in improvised intrenchments, where they sustained a siege for nineteen days under the sun of a tropical June. At last, trusting to a safe conduct from the Nana as far as Allahabad, they surrendered their position, and to the number of 450 individuals embarked in boats on the Ganges. Forthwith a murderous fire was opened upon them from the river bank. Only a single boat escaped, and but four men, who swam across to the protection of a friendly rajah, ultimately survived to tell the tale. The rest of the men were massacred on the spot; the women and children, numbering 125, were reserved for the same fate a few days later,

when the avenging army of Havelock was at hand. Sir Henry Lawrence, the chief commissioner of Oudh, had foreseen the coming storm with a prophetic eye. He had fortified and provisioned the residency at Lucknow in good time, and thither he retired with all the European inhabitants and a weak British regiment on July 2d. Two days later he was mortally wounded by a shell. But his example inspired the little garrison to hold out under unparalleled hardships and against enormous odds, until relieved by Havelock and Outram on September 25th. But the relieving force was itself invested by fresh swarms of rebels, and it was not till November that Sir Colin Campbell, afterward Lord Clyde, cut his way into Lucknow, and effected the final deliverance of the garrison. The siege of Delhi began on June 8th, just one month after the original outbreak at Meerut. Siege in the proper sense of the word it was not, for the British army, encamped on the historic ridge, never exceeded 8,000 men, while the rebels within the walls were more than 30,000 strong.

In the middle of August Nicholson arrived with a re-enforcement from the Punjab, but his own encouraging presence was more valuable than the re-enforcement he brought. On September 14th the assault was delivered, and after six days' desperate fighting in the streets Delhi was again won. Nicholson fell at the head of the storming party. Hodson, the intrepid leader of a corps of irregular horse, hunted down and brought in as prisoner the old Mughal emperor, Bahadur Shah, and then in cold blood shot down the emperor's sons with his own hand. After the fall of Delhi and the final relief of Lucknow, the war loses its dramatic interest, though fighting went on in various parts of the country for eighteen months longer. The population of Oudh and Rohilkhand, stimulated by the presence of the begum of Oudh, the nawab of Bareilly, and Nana Sahib himself, had joined the mutinous sepoys *en masse*. In this quarter of India alone, it was the revolt of a people rather than the mutiny of an army that had to be quelled. Sir Colin Campbell in person conducted the campaign in Oudh, which lasted through two cold seasons. Valuable assistance was lent by Sir Jang Bahadur of Nepal, at the head of a numerous army of Gurkhas. Town after town was occupied, fort after fort was stormed, until at length the last gun had been recaptured and the last fugitive had fled across the frontier by January, 1859. In the meanwhile Sir Hugh Rose (afterward Lord Strathnairn), with another army from Bombay, was conducting an equally brilliant campaign in Central India. His most formidable antagonists were the disinherited rani of Jhansi, and Tantia Topi, whose military talent had previously inspired Nana Sahib with all the capacity for resistance that he ever displayed. The rani died fighting bravely at the head of her troops in June, 1858; Tantia Topi, after doubling backward and forward through Central India, was at last betrayed and run down in April, 1859.

The Mutiny sealed the fate of the East India Company, after a life of more than two and a half centuries.

The Company received its original charter of incorporation from Elizabeth in 1600. Its political powers and the constitution of the Indian Government were derived from the Regulating Act of 1773, passed by the ministry of Lord North. By that statute the governor of Bengal was raised to the rank of governor-general; and, in conjunction with his council of four other members, he was intrusted with the duty of superintending and controlling the governments of Madras and Bombay so far as regarded questions of peace and war; a supreme court of judicature was instituted at Calcutta, to which the judges were appointed by the crown; and a power of making rules, ordinances, and regulations was conferred upon the governor-general and his council. Next came the India Bill of Pitt (1784), which founded the board of control, strengthened the supremacy of Bengal over the other presidencies, and first authorized the historic phrase "governor-general-in-council." The act which abolished the Company's monopoly of trade (1833) also introduced several reforms into the constitution of the Indian Government, and added to the council an additional member, who might not be chosen from among the Company's servants, and was entitled to be present only at meetings for making laws and regulations; it gave the authority of acts of Parliament to the laws and regulations so made, subject to the disallowance of the court of directors; it appointed a law commission; and it gave the governor-general-in-council a control over the other presidencies in all points relating to the civil or military administration. The charter of the Company was renewed for the last time in 1853, not for a definite period of years, but only for so long as Parliament should ordain. On this occasion the number of directors was reduced, and their patronage as regards appointments to the civil service was taken away, to make room for the principle of open competition.

The act for the better government of India (1858), which finally transferred the entire administration from the Company to the crown, was not passed without an eloquent protest from the directors, nor without acrimonious party discussion in Parliament. It enacts that India shall be governed by, and in the name of, the sovereign of England through one of the principal secretaries of state, assisted by a council of fifteen members. The governor-general received the new title of viceroy. The European troops

of the Company, numbering about 24,000 officers and men, were amalgamated with the royal service, and the Indian navy was abolished. By the Indian Councils Act (1861) the governor-general's council and also the councils at Madras and Bombay were augmented by the addition of non-official members, either natives or Europeans, for legislative purposes only; and by another act passed in the same year high courts of judicature were constituted out of the existing supreme courts at the presidency towns.

It fell to the lot of Lord Canning both to suppress the Mutiny and to introduce the peaceful revolution that followed. As regards his execution of the former part of his duties, it is sufficient to say that he preserved his equanimity undisturbed in the darkest hours of peril, and that the strict impartiality of his conduct incurred alternate praise and blame from the fanatics on either side. The epithet then scornfully applied to him of "Clemency" Canning is now remembered only to his honor. On November 1, 1858, at a grand *darbar* held at Allahabad the royal proclamation was published which announced that the queen had assumed the government of India. This document, which has been called the Magna Charta of the Indian people, went on to explain the policy of political justice and religious toleration which it was her royal pleasure to pursue, and granted an amnesty to all except those who had directly taken part in the murder of British subjects. Peace was proclaimed throughout India on July 8, 1859; and in the following cold weather Lord Canning made a viceregal progress through the upper provinces, to receive the homage of loyal princes and chiefs, and to guarantee to them the right of adoption. The suppression of the Mutiny increased the debt of India by about £40,000,000 sterling, and the military changes that ensued augmented the annual expenditure by about £10,000,000. To grapple with this deficit, Mr. James Wilson was sent out from the treasury as financial member of council. He reorganized the customs system, imposed an income tax and license duty, and created a state paper currency. The penal code, originally drawn up by Macaulay in 1837, passed into law in 1860, together with a code of civil and criminal procedure.

Lord Canning left India in March, 1862, and died before he had been a month in England. His successor, Lord Elgin, only lived till November, 1863, when he, too, fell a victim to the excessive work of the governor-generalship, dying at the Himalayan station of Dharmasāla, where he lies buried. He was succeeded by Sir John Lawrence, the savior of the Punjab. The chief incidents of his administration were the Bhutan war and the terrible Orissa famine. Lord Mayo, who succeeded him in 1869, carried on the permanent British policy of moral and material progress with a special degree of personal energy. The Ambala (Umballa) *darbar*, at which Shere Ali was recognized as amir of Afghanistan, though in one sense merely the completion of what Lord Lawrence had begun, owed much of its success to the personal influence of Lord Mayo himself. The same quality, combined with sympathy and firmness, stood him in good stead in all his dealings both with native chiefs and European officials. His example of hard work stimulated all to their best. While engaged in exploring with his own eyes the farthest corners of the empire, he fell by the hand of an assassin in the convict settlement of the Andaman Islands in 1872. His successor was Lord Northbrook, whose ability showed itself chiefly in the department of finance. During the time of his administration a famine in Lower Bengal in 1874 was successfully obviated by government relief and public works, though at an enormous cost; the gaikwar of Baroda was dethroned in 1875 for misgovernment and disloyalty, while his dominions were continued to a nominated child of the family; and the Prince of Wales made a tour through the country in the cold weather of 1875-76. Lord Lytton followed Lord Northbrook in 1876.

On January 1, 1877, Queen Victoria was proclaimed Empress of India at a *darbar* of unequaled magnificence, held on the historic "ridge" overlooking the Mughal capital of Delhi. But, while the princes and high officials of the country were flocking to this gorgeous scene, the shadow of famine was already darkening over the south of India. Both the monsoons of 1876 had failed to bring their due supply of rain, and the season of 1877 was little better. The consequences of this prolonged drought, which extended from the Deccan to Cape Comorin, and subsequently invaded northern India, were more disastrous than any similar calamity since the introduction of British rule. Despite unparalleled importations of grain by sea and rail, despite the most strenuous exertions of the government, which incurred a total expenditure on this account of £11,000,000, the loss of life from actual starvation and its attendant train of diseases was lamentable. The total number of deaths from disease and want in the distressed tracts in excess of the normal mortality for the two years 1876-78 is estimated to have raised the death-rate by 40 per cent., or 5,250,000. In the autumn of 1878 the affairs of Afghanistan again forced themselves into notice. Shere Ali, the amir, who had been hospitably entertained by Lord Mayo, was found to be favoring Russian intrigues. A British embassy was refused admittance to the country, while a Russian mission was received with honor. This led to a declaration of

war. British armies advanced by three routes—the Khaibar (Khyber), the Kuram, and the Bolan—and without much opposition occupied the inner entrances of the passes. Shere Ali fled to Afghan Turkestan, and there died. A treaty was entered into with his son, Yakub Khan, at Gandamak, by which the British frontier was advanced to the crests or further sides of the passes, and a British officer was admitted to reside at Cabul. Within a few months the British resident, Sir Louis Cavagnari, was treacherously attacked and massacred, together with his escort, and a second war became necessary. Yakub Khan abdicated, and was deported to India; Cabul was occupied in force, and an Afghan chief of the Durani line was placed in the government of Kandahar with the title of wali. At that crisis of affairs a general election in England resulted in a defeat of the ministry. Lord Lytton resigned with the Conservative ministry, and the marquis of Ripon was nominated as his successor in 1880. Since then, a British brigade received a defeat between Kandahar and the Helmand river from the Herati army of Ayub Khan, a defeat promptly and completely retrieved by the brilliant march of General Sir Frederick Roberts from Cabul to Kandahar, and by the total rout of Ayub Khan's army on September 1, 1880. Abdurrahman Khan, the eldest male representative of the stock of Dost Muhammad, is now recognized as amir of Cabul.

THE GOVERNMENT OF INDIA.

The viceroy and governor-general, who is appointed by the crown, and whose ordinary term of office is five years, is supreme, but he is assisted by an executive council of six members, including the commander-in-chief. Power is reserved to him of overruling his council; but all acts of the government run in the name of the "governor-general in council." This body, forming the supreme government in India, passes in review the entire administration in six separate departments—finance and commerce, foreign, military, public works, home and the department of revenue and agriculture. Each department is under the charge of a secretary, and is also the special care of a member of the supreme council who has authority to deal with affairs of routine and minor importance, and to select what is worthy of the consideration of the governor-general and his collective council. The governor-general specially superintends the political business of the foreign office. The department of finance and commerce looks to questions of finance, to stamps, excise, the postoffice, and anything involving a permanent charge on the state; also to questions bearing on the commerce of the country. The most important subjects coming under the attention of the department of revenue and agriculture are the land revenue, forests, and the agricultural development of the country. The home department deals with the educational, medical, sanitary, ecclesiastical, judicial, municipalities, local government boards, police, and other matters, and has charge of the penal settlements of Port Blair and Nicobar. The foreign department conducts our relations with Afghanistan, Nepal and other conterminous countries, and corresponds with the political agents of the numerous semi-independent native states of Rajputana and Central India, with the residents of Mysore, Cashmere, Baroda and Hyderabad. The marine service, as well as the army, is under the military department. The legal member takes charge of government bills in the legislative council, which consists of twelve members (besides the seven members of the executive council), of whom one-half must be unconnected with the public service. As only Bengal, Madras, Bombay and the Northwest Provinces possess councils of their own, the legislative council of India legislates for those provinces which are unprovided with local councils, or on matters of exceptional importance affecting the empire.

Separate high courts have been established for the presidencies of Madras and Bombay and for the lieutenant-governorship of Bengal (with jurisdiction also over Assam) and of the Northwest Provinces. The Punjab has a chief court; the Central Provinces, Oudh and Mysore, have each a judicial commissioner, and Burmah has a judicial commissioner and a recorder.

The Government of India is debited with the cost of the army for all India, with the interest on debt, and, generally, with all imperial as distinguished from provincial expenditure.

PROVINCES OF BRITISH INDIA.

The term "presidency," which is applied to the provinces or governments of Bengal, Madras and Bombay, is no longer correct, and in the case of Bengal is misleading. The expression is a relic of the time when the three settlements of Fort William, Fort St. George, and Bombay were each under the authority of a president, and comprised nearly the whole of the British possessions in India. Its use now frequently leads to the mistaken notion that British India is still divided into three presidencies; whereas it comprises nine separate provinces, each under its own civil government, but subordinate to the supreme government.

NATIVE STATES OF INDIA.

The native states of India cover an area of 610,000 square miles. They contain a population of about 61,000,000, and their

united military forces are estimated at more than 300,000 men, mostly ill-armed and ill-disciplined. The gross revenues of the chiefs come to about Rx. 18,000,000, out of which an annual tribute of nearly Rx. 700,000 is paid to the British Government. The states vary greatly in size and importance. Hyderabad, for instance, is as large as the kingdom of Italy, and the Nizam enjoys a gross revenue of Rx. 3,330,000. On the other hand, in Kattywar and elsewhere, where family custom has led to minute subdivision, there are many chiefs of a single village. Between these two extremes there are states of every grade. Although, therefore, the number of Native States, large and small, amounts to as many as 800, only about 200 are of any importance. They may be classed under fourteen heads: 1. The Indo-Chinese group of States, and the numerous Hill tribes of the northeast frontier. 2. The aboriginal Gond and Kole tribes in Chota Nagpur, Orissa, the Central Provinces, and the Jaipur (Vizagapatam) Agency. 3. The Himalayan Hill States west of Nepaul (including Cashmere). 4. The numerous Afghan and Belooch tribes of the northwest frontier, inhabiting the mountains from the north of Peshawar to the base of the Suleiman range, a distance of 800 miles. 5. The Sikh States, in the Sirhind plain, south of the Sutlej. 6. The three Northern Mohammedan States of Khairpur in Sind, Bahawalpur to the northeast of it, and Rampur, from which Warren Hastings expelled the Rohillas in 1774. 7. The ancient sovereignties of Rajputana, lying to the south of the Punjab, and between Sind and the Northwest Provinces. 8. The States of Central India, lying to the north of the Nerbudda, and to the south and east of Rajputana. 9. Guzerat, including Kutch, and the numerous petty chiefships, of Kattywar. 10. The southern Marhatta States. 11. Baroda. 12. Hyderabad. 13. Mysore. 14. The Malayalam States of Travancore and Cochin, lying together in the far south.

The Nizam of Hyderabad, on the attainment of his majority, was installed in the presence of the viceroy, on February 5, 1884. Cashmere was granted to Gholab Sing by Lord Hardinge, after the first Punjaub war. His son and successor, Runbir Sing, died on September 12, 1885, and was succeeded by the present Maharaja, Pertab Sing, when also a British Resident was appointed and stronger pressure was brought to bear in favor of much needed reforms in the government. In 1889, in consequence of continued misgovernment, the Maharaja was deprived of his powers, which were intrusted to a native council, assisted by the advice of the Resident. Cashmere commands important trade routes to Central Asia, and is renowned for the beauty of its scenery and the excellence of its climate. Of the Sikh States the most important is Patiala. Rajputana measures some 460 miles from north to south, and 530 miles in breadth; it has a population of about ten and one-quarter millions. Of the nineteen principalities, the most important are Jodhpur (Marwar), Oudipur (Meywar) and Jaipur. The Rajput dynasties are very ancient. They offered the most obstinate resistance to the Mohammedan invaders, but were finally conquered by Sultan Baber, at the battle of Sikri, near Agra, in 1527. The governor-general's agent, whose headquarters are at Ajmir, had under him a staff of twenty officers, who are distributed among the States to overlook the administration, and give advice when it is needed or asked for. The military forces of these States are set down at 70,000 men. The Central India States, which are one-third less in extent than Rajputana, are split up into nearly four times as many states. The two most important are Gwalior and Indore, which include between them one-half of the whole area. Scindia has an admirably equipped army of more than 20,000 men. The historic fortress of Gwalior, which had been held by the British since the mutiny, was given back to Scindia in 1886. The opium grown in Malwa is a valuable source of revenue to the Maharaja of Indore and to the Indian Government. Bhopal, one of the principal Mohammedan States of India, has for three generations prospered under female rule. In 1875 the reigning Gaekwar of Baroda was deposed, but the native administration was continued under an adopted heir. In 1881 the province of Mysore, which had been administered by the British Government since 1834, was restored to the Maharaja Chamrajendra Wadiar Bahadur on his attaining his majority. The revenue slightly exceeds Rx. 1,000,000, and the tribute to the British Government is Rx. 250,000.

A number of the most important native chiefs gave proof of their loyalty in 1888 by offering their troops and large sums of money to the Indian Government to aid the defense of the northwest frontier. Actual sums of money were offered, by the Nizam of Hyderabad 60 lacs, Jeypore 15 lacs, Kashmir and Jodhpur 10 lacs each, and by several other States, and these and other States placed their troops and resources at the service of the Indian Government. The offers of money have been declined, but progress has been made in organizing a system by which these States will be able to render efficient aid to the supreme government in times of emergency.

RAILWAYS, ETC.

The number of miles open for traffic on March 31, 1889, was 15,243; in addition there were 2,272 miles of line then under construction, or already sanctioned for construction.

The army in India (April 1, 1888) had an actual strength of 288,567 officers and men (British troops 69,910, native 218,657). Six garrison batteries of royal artillery were added to the Indian establishment in 1887-88. This completed the increase to the army in India sanctioned in 1885. Only nine out of ninety-seven batteries of artillery are native. There are nine British cavalry regiments and fifty-three British infantry battalions. The native troops contain forty-eight regiments and corps of cavalry, and 127 battalions and corps of infantry. For police duties and frontier service the regular military is supplemented by about 163,000 native police, officered mainly by Europeans. There were in addition, in 1887-88, 18,388 enrolled European volunteers, of whom 15,458 were declared efficient. A reserve force of native soldiers is also being organized.

Some military operations had still to be carried on in Upper Burmah among the wild border tribes. It was, however, found possible to reduce the military garrison of that province from 26,000 to 12,000 men. The operations against the Tibetans, who had occupied Lingtu and the Jalapla Pass in Sikkim, were successfully terminated. Slighter troubles also occurred on the Chittagong frontier, where the raiding tribes had to be punished.

Education has made steady progress of late years. The number of educational institutions in 1887-88 was 133,352, and the number of students was 3,473,895, as compared with 63,775 schools and 1,812,382 students in 1878-79. Of the institutions, 18,278 were maintained by the State, and 60,026 aided by grants. The remainder were private and unaided. The policy of the government aims principally at improving and extending elementary education. There are five universities in India, founded on the model of the University of London, viz., those of Calcutta, Madras and Bombay, the Punjab University, and a fifth that was opened in 1887 at Allahabad.

The Indian municipalities began for the most part in 1884-85 to enjoy the more popular system of representation granted to them by Lord Ripon's measures of local self-government. The result appears to have been moderately successful. Some municipalities which were prematurely started have been closed, and the number existing in India in 1887-88 was 726, as compared with 749 in 1885-86. Their total expenditure amounted in 1887-88 to nearly 30,000,000 rupees. In several provinces local self-government by means of representative district boards has been largely introduced for rural districts.

NATIVE PRINCES.

The most important of the native princes are:—

PRINCES.	Sq. M.	Pop. 1881.	Revenue. Rx.*
Nizam of Hyderabad.....	81,807	9,845,594	3,330,000
Gaekwar of Baroda.....	8,570	2,185,005	1,523,000
Maharaja of Gwalior.....	29,067	3,115,857	1,120,000
“ Mysore.....	24,723	4,186,188	1,020,000
“ Cashmere.....	80,000	1,534,972	700,000
“ Travancore.....	6,730	2,311,379	667,000
“ Jaipur.....	14,465	2,534,357	603,000
“ Indore.....	8,402	1,055,217	574,000
“ Patiala.....	5,887	1,467,433	479,000
“ Jodhpur.....	37,000	1,750,403	407,000
Begum of Bhopal.....	6,874	954,901	351,000
Thakor Saheb of Bhawnagar....	2,860	400,323	348,000
Rajah of Kolhapur.....	2,816	800,189	312,505
Maharaja of Bhurtpur.....	1,974	645,450	264,000
“ Ulwar.....	3,024	682,926	261,000
“ Oudipur.....	12,670	1,494,220	260,000

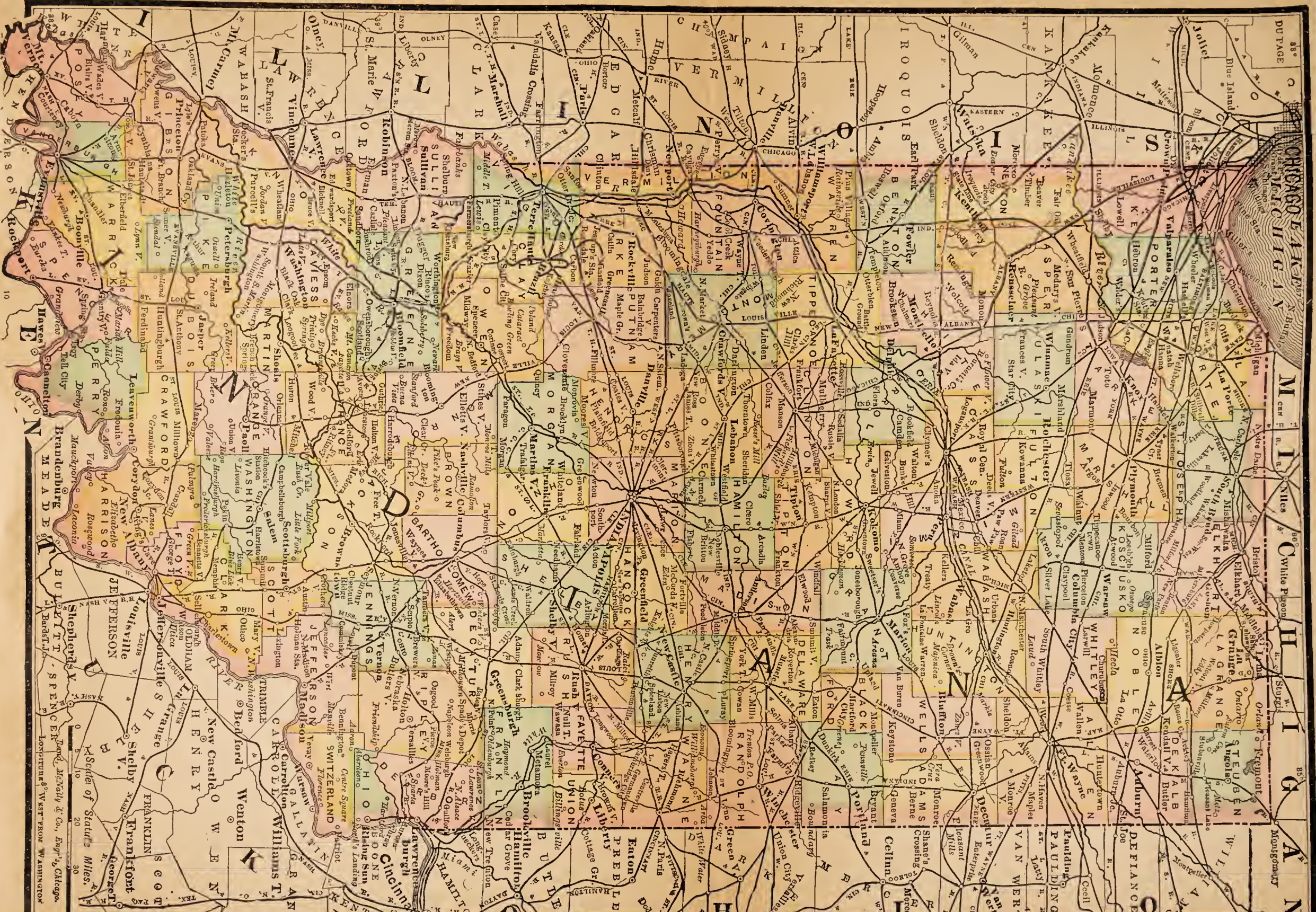
*Rx. 10 Rupees, nominally equivalent to £1. †In 1873.

GOVERNORS-GENERAL OF INDIA UNDER THE EAST INDIA COMPANY, 1765-1858.

1765. Lord Clive.	1806. Earl of Minto.
1767. Harry Verelst.	1813. Earl of Moira (Marquis of Hastings).
1769. John Cartier.	1823. John Adam, (<i>pro tem.</i>)
1772. Warren Hastings.	1823. Lord Amherst.
1786. Lord (afterward Marquis) Cornwallis.	1828. Lord William Cavendish Bentinck.
1793. Sir John Shore (Lord Teignmouth).	1835. Sir Charles Metcalfe (Lord Metcalfe).
1798. Sir Alured Clarke, (<i>pro tem.</i>)	1836. Lord Auckland.
1798. Lord Mornington (Marquis Wellesley).	1842. Earl of Ellenborough.
1805. Lord Cornwallis again.	1844. Viscount Hardinge.
1805. Sir George Barlow, (<i>pro tem.</i>)	1848. Earl (afterward Marquis) of Dalhousie.
	1856. Earl Canning.

VICEROYS OF INDIA UNDER THE CROWN, 1858-1890.

1858. Earl Canning.	1872. Lord Northbrook.
1862. Earl of Elgin.	1876. Lord Lytton.
1864. Sir John Lawrence (Lord Lawrence).	1880. Marquis of Ripon.
1869. Earl of Mayo.	1885. Earl Dufferin.
	1888. Marquis of Lansdowne.



INDIANA, one of the States of the Union, is bounded on the east by the State of Ohio; on the south by the Ohio river; on the west by Illinois; on the north by the State of Michigan and Lake Michigan. The coast line is about sixty miles in length. The extreme length of the State is 276 miles, with an average breadth of 145 miles; and the area is 33,809 square miles.

Indiana occupies a table-land, gently undulating, except along the Ohio. There are no mountains or mountain ranges. With the exception of a small portion, the whole State inclines toward the southwest. The mean altitude of the State is estimated at 735 feet above sea-level. It is well watered. The Wabash is the largest river, and, with its branches, it drains three-fourths of the surface. The country south of the Wabash was originally covered with heavy forests of oak, beech, maple, walnut, ash and other hard woods; north of that river was principally prairie interspersed with small lakes.

The coal-measures occupy over 7,000 square miles in the western and southwestern parts, furnishing workable seams, at a depth of 50 to 220 feet; the seams vary in thickness from two and a half to eleven feet; an area of 600 square miles in this field yields a superior "block" or splint coal. This is used in blast furnaces without coking, and is well adapted for the preparation of Bessemer steel. Natural gas has been discovered and utilized as a fuel and illuminating agent in various portions of the State and the supply is apparently very great.

Inexhaustible beds of fireclay, potter's clay, kaolin, lime and paving and building stone are found in the southern parts of the State.

Agriculture is the chief branch of industry, the climate and soil being suited to the growth of cereals, fruits and grasses.

Climate.—The climate is equable and healthy. The mean height of the barometer is 30.010 inches. The prevailing winds are from the south and west in summer, veering round to the north in winter. The temperature has not as great a range as some of the neighboring States, averaging 20° in winter and 95° in summer.

The manufacturing interests have increased rapidly during the last decade. The increase of wealth is shown as follows by the appraisement for taxation:—

1850.....	\$202,650,264
1860.....	411,042,424
1870.....	663,455,044
1880.....	767,387,172
1890.....	776,813,458

So completely does the railway system cover the State that one can go from the capital to almost any county and return the same day. The geographical position of the State is such that all the main railroad through-lines between the east and west have to cross Indiana.

The State is divided into ninety-two counties. The governor is elected for four years. The legislature, which meets biennially, consists of a senate of fifty, elected for four years, and a house of representatives of one hundred, elected for two years. The judges (five) of the supreme court are elected for six years. All elections by the legislature are *viva voce*. The foreign State debt is \$8,056,615, and the domestic debt \$484,000. The tax for State purposes is 12 cents and for schools 16 cents on the \$100.

Official returns for 1890, show the following production of cereals and hay:

CROP.	ACRES.	BUSHEL.	VALUE.
Wheat.....	2,821,129	28,352,346	\$26,284,158
Corn.....	8,446,439	87,092,513	43,546,256
Oats.....	1,019,398	15,566,207	7,316,127
Hay.....	2,438,667	4,169,645 (tons)	45,866,905

The number and value of live stock in 1890 was as follows:

NAME.	NUMBER.	VALUE.
Horses.....	602,361	\$48,188,880
Mules.....	52,856	4,281,336
Cattle.....	1,426,888	31,605,568
Sheep.....	1,234,741	3,765,690
Hogs.....	4,076,412	21,604,988

The annual report of the State superintendent of public instruction of date January 1, 1889, furnishes the following data: Enumeration of persons of school age (six to twenty-one years): Males, white, 386,822; colored, 9,893; females, white, 364,527; colored, 9,633; grand total, 770,875. The enrollment included 269,726 males and 253,361 females; total enrollment, 523,147. Average daily attendance, 350,752. Teachers, 6,776 male, 6,477 female; total, 13,253. There were 9,928 school houses. The common school fund for the year amounted to \$3,303,148, an increase of \$56,794 over the preceding year; the congressional school fund was \$2,557,666, an increase of \$10,894 over 1888. The total school funds, June, 1889, amounted to \$9,765,598, which included \$3,904,783 of non-negotiable bonds. The value of school property and apparatus, in 1889 was \$14,879,245. During the year 301 school houses, of a value of \$536,878 were erected.

The State university is at Bloomington, and the State normal school at Terre Haute. The function of the latter is to fit its pupils to become teachers in the common schools. **Purdue University, at Lafayette, is the State agricultural college.** There are also a number of colleges, mainly under the control of religious societies, chief among which are Asbury University (Methodist) at Greencastle, Wabash College (Presbyterian) at Crawfordsville, Butler University (Christian) at Irvington (near Indianapolis), Notre Dame (Catholic) at South Bend, and Earlham College (Friends) at Richmond.

Population.—In point of population Indiana ranks as eighth State in the Union. The white inhabitants in 1765 are stated to have consisted of a few French families along the Wabash. The following table shows the population at decennial periods during this century:—

Year.	White.	Colored.	Total.
1800	4,577	298	4,875
1810	23,890	630	24,520
1820	145,758	1,420	147,178
1830	339,399	3,632	343,031
1840	678,698	7,168	685,866
1850	977,154	11,262	988,416
1860	1,338,710	11,428	1,350,428
1870	1,655,837	24,560	1,680,637
1880			1,976,261

The official census returns of 1890 show a total population of 2,192,404.

The following are the chief towns, with official population in 1890—Indianapolis, 105,436; Evansville, 50,756; Fort Wayne, 35,393; Terre Haute, 30,217; New Albany, 21,059; Lafayette, 16,243; South Bend, 21,819; Richmond, 16,608; Logansport, 13,228; Jeffersonville, 10,666.

History.—Indiana originally constituted a part of New France. It was visited by the Jesuits as early as 1672. At the beginning of the eighteenth century the French opened a line of communication between the lakes and the Mississippi by way of the Maumee, Wabash, and Ohio rivers. Trading posts for barter with the natives were established at the head of the Maumee, where is now the city of Fort Wayne; at Ouantenon, on the Wea Prairie, near the city of Lafayette; and at Vincennes on the Wabash. Missionary stations were also established by the Jesuit fathers, in their endeavor to

convert the Indians. At the close of the French war in 1763-4, the territory east of the Mississippi and north of the Ohio passed under British dominion. Pending the war between Great Britain and the American colonies, Col. George Rogers Clark of Virginia, with an armed force, took possession of the territory, raising the American flag at Vincennes in 1778. By the treaty of 1783 between England and the United States this territory was recognized as belonging to the latter; inasmuch as Virginia had fitted out Clark's expedition, she was entitled by the law of conquest to claim this vast dominion. During the colonial war Congress recommended the several States to cede their claims to unappropriated lands in the western country to the general government for the common benefit of the Union. Virginia, in pursuance of this request, yielded up her claims to the territory northwest of the Ohio. The deed of cession, executed on March 1, 1784, was signed by Thomas Jefferson, James Monroe, Arthur Lee, and Samuel Hardy. In 1787 Congress passed an ordinance for the government of the Northwest Territory, which provided, among other things, that not more than five States should ever be formed therefrom, prohibiting slavery, and declaring that "religion, morality, and knowledge being necessary to good government and the happiness of mankind, schools and the means of education shall forever be encouraged." This territory was subsequently divided into the States of Ohio, Indiana, Illinois, Michigan, and Wisconsin. Indiana was admitted into the Union as a State by Congress on April 19, 1816, being the sixth State received after the formation of the government by the thirteen original States and the adoption in 1787 of the present constitution.

INDIAN ARCHIPELAGO. The East Indian Archipelago or Malay Archipelago, the largest island cluster in the world, lies to the southeast of Asia and to the north and northwest of Australia, and bears the impress in many of its most important characteristics, both natural and historical, of this twofold relation.

As the archipelago does not form a political unity, different writers assign it very different limits, according as they are influenced by one set of considerations or another. New Guinea to the east and the Philippines to the north are sometimes included and sometimes excluded; Sumatra is sometimes regarded as the most western member of the group, and sometimes that position is given to the Nicobar or the Andaman Islands. From the following survey of the extent of the archipelago the Malay peninsula and New Guinea are excluded, but the Andaman Islands are admitted as having at least an ethnographical claim. The Balintong Strait, about the 20th parallel of N. latitude may be taken as the northern limit; and but for a small portion of the islands Timor and Sumba (Sandalwood Island), with their insignificant adjacencies, the southern limit might be stated as the 10th of S. latitude. The Andaman Islands extend almost to 93° E. longitude, the Aru Islands as far east as 135°. The equator passes through the middle of the archipelago; it successively cuts Sumatra, Borneo, Celebes, and Jilolo, four of the most important islands. To adopt Mr. Wallace's graphic sentences (noting that he embraces New Guinea and the Solomon Islands), the archipelago "includes two islands larger than Great Britain; and in one of them, Borneo, the whole of the British Isles might be set down, and would be surrounded by a sea of forests. Sumatra is about equal in extent to Great Britain; Java, Luzon, and Celebes are each about the size of Ireland. Eighteen more islands are on the average as large as Jamaica; and more than a hundred are as large as the Isle of Wight."

The statistics of the area and population of the several islands can only be given approximately. The following table is based on statements contained in the sixth number of Behm and Wagner's *Die Bevölkerung der Erde* (Gotha, 1880):—

	Area. Sq. miles	Population.
I. Andaman and Nicobar Islands.....	3,192	20,000
II. Sunda and Molucca Islands.....	655,720	27,343,000
(1) Borneo group.....295,007 sq. m.		
(2) Sumatra group...179,458 "		
(3) Java group 50,849 "		
(4) Lesser Sunda group..... 35,152 "		
(5) South Western group..... 2,021 "		
(6) Tenimber, Aru, and Ke Islands 5,356 "		
(7) Moluccas..... 20,549 "		
(8) Celebes group... 77,250 "		
III. Philippine Islands.....	114,096	7,450,000
Total.....	773,008	34,813,000

The total area is thus rather less than that of British India, and the population rather more than that of Great Britain and Ireland.

The islands of the archipelago nearly all present bold and picturesque profiles against the horizon, and at the same time the character of the scenery varies from island to island and even from district to district. The mountains arrange themselves for the most part in lines running either from northwest to southeast or from west to east. In Sumatra and in the islands between Sumatra and Borneo the former direction is very distinctly marked, and the latter is equally noticeable in Java and the other southern islands. The mountains of Borneo rise rather in short ridges and clusters from the plain, like islands from the sea; the arrangement represented on even what are considered authoritative maps being, like much else in the cartography of the archipelago, the product of imagination. Nothing in the general physiognomy of the islands is more remarkable than the number and distribution of the volcanoes, active or extinct.

An important fact in the physical geography of the archipelago is that Java, Bali, Sumatra, and Borneo, and the lesser islands between them and the Asiatic mainland, all rest on a great submerged bank, nowhere more than 100 fathoms below the surface of the sea, which may be considered a continuation of the continent; while to the east the depth of the sea has been found at various places to be from 1,000 to 2,500 fathoms. As the value of this fact has been particularly emphasized by Mr. Wallace, the limit of the shallow water, which passes through between Bali and Lombok, and strikes north to the east of Borneo, has rightly received the name of Wallace's line. The Philippines, on the other hand, "are almost surrounded by deep sea, but are connected with Borneo by means of two narrow submarine banks."

Most of the islands of the archipelago belong to that great forest-belt which girdles the earth at the equator, clothing hill, plain, and mountain with an evergreen mantle. In islands and districts where human civilization has been at work for centuries, the natural covering has in large measure given place to artificial tilth; and in Timor and several of the southeastern islands the characteristics of New Guinea—luxuriant herbage and open park-like woodlands—are more or less strikingly predominant. The field for botanical research in the archipelago is still vast and alluring. Among the very giants of the forest the unregistered species must be numerous; and, if we descend to the minor forms,

it is a very poor collection that does not yield something absolutely new to science. The ferns, the pitcher plants, and the orchids are especially numerous, and have attracted particular attention. The volcano of Pangerango, in Java, is said to have, for example, yielded 300 species of ferns; and Mr. Burbidge, in a short excursion in Borneo in 1879, found upward of fifty species that had not been previously obtained in the island.

If we turn to the economical aspect of the vegetation, whether natural or cultivated, we cannot fail to be impressed by its varied resources. The list of fruits is a very extensive one; though unfortunately it is only with a very few of them that the untraveled European can have any practical acquaintance. Besides the orange, the mango, the mangosteen, the pomato or shaddock, the guava, the pawpaw, and the jack fruit, we have the rambutan, the tarippe or trap, the jintawan, the tampu, the bilimbing, the mamhangan, the langsat, the rambi, and the jambosa. The name at least of the durian is now well known (see *DURIAN*), and nearly as strange is the bawangutan, of which the fruit, the leaves, and the branches have all a strong odor and flavor of onions. Of what more distinctly deserve the name of food-plants the variety is equally notable. Not only are rice and maize, sugar and coffee, among the widely cultivated crops, but the cocoa-nut, the bread fruit, the banana and plantain (usually called *pisang* in the archipelago), the sugar-palm, the tea-plant, the sago-palm, the cocoa-tree (which curiously yields the favorite beverage of the Sulu archipelago), the ground-nut, the *Caladium esculentum*, the yam, the cassava, and others beside, are of practical importance. The cultivation of sugar and coffee owes its development mainly to the Dutch; and to them also is due the introduction of tea. They have greatly encouraged the cultivation of the cocoa-nut among the natives, and it now flourishes, especially in the coast districts, in almost every island in their territory. The oil is very largely employed in native cookery. The sago-palm is most abundant in the island of Ceram, but is also found growing wild in Borneo, Celebes, Timor, and other islands of the Moluccas, in the Linga archipelago, and in parts of Sumatra. The product is mainly prepared for export. Pepper, nutmeg, and cloves were long the objects of the most important branch of Dutch commerce; and camphor, dammar, benzoin, and other products of a similar kind have a place among the exports. India-rubber and gutta-percha are no longer obtained to the same extent as formerly.

To the naturalist the Indian archipelago is a region of the highest interest; and from an early period it has attracted the attention of explorers of the first rank. And yet the list of its living forms is far from being completely ascertained. The best known district is western Java, and Timor, the Moluccas, and the Papuan Islands have for the most part been well explored. Only parts of Sumatra, Borneo, and Celebes have been worked, and most of the other islands have yet to be dealt with. Zoologically the archipelago belongs to two distinct regions—the eastern or Papuan, and the western or Malay or Indian. Six genera of the *Quadrupedia*, fourteen of the *Chiroptera*, five of the *Insectivora*, fourteen of the *Carnivora*, six of the *Rodentia*, of the *Edentata* one only (*Manis*), five of Ruminants, and three of Pachyderms are enumerated. Sumatra indicates a connection with the Malacca peninsula by *Nemorhædus*, the elephant, *Gymnura*, and the tapir. *Pithecius*, *Tarsius*, and *Ptilocercus* seem peculiar to the Sunda Islands. The Philippines have *Semnopithecus*, *Macacus*, *Cynopithecus*, *Galeopithecus*, *Pteropus*, *Taphozous*, *Vespertilis*, *Viverra*, *Paradoxurus*, *Pteromys*, *Mus*, *Rusa*, and *Cervulus*.

The ethnology of the Indian archipelago does not lack its difficult problems; but some outstanding features are easily described. There are at least two main native races, the brown, long-haired Malay and the darker-skinned, frizzly-haired Papuan. And to these more recent explorations make it almost certain that a third and probably more thoroughly aboriginal race—the Negrito—must be added, though even specialists who have had opportunities of direct observation are not unanimous in regard to this noteworthy element. The Malays are subdivided into an immense number of tribes and peoples in the most various stages of civilization, and broadly differenced from each other by physical and linguistic characteristics. Of chief note are the Malays proper, the Javanese, the Bugis, the Tagalas, and Bisayas, the people of the Moluccas, the Dayaks (mainly in Borneo), the Battaks of Sumatra, the Sulu islanders (closely similar to the tribes of northern Borneo). The Papuan race is chiefly to be found in the eastern section of the archipelago. Besides these three races, whose first connection with the archipelago dates from before the dawn of history, we have a variety of intrusive elements, traceable by more or less strictly historical documents. A Hindu strain is evident in Java and others of the western islands; Moors and Arabs (that is, as the names are used in the archipelago, Mahometans from various countries between Arabia and India) are found more or less amalgamated with many of the Malay peoples; and the Chinese form, in an economical point of view, one of the most important sections of the community in many of the more civilized districts. Chinese have been established in the archipelago from a very early date; the first Dutch invaders found them settled at Jacatra; and many of them, as, for instance, the colony of Ternate, have taken so kindly to their new home that they have acquired Malay to the disuse of their native tongue. Chinese tombs are among the objects that strike the traveler's attention at Amboyna and other ancient settlements.

There is a vast field for philological explorations in the archipelago. Of the very great number of distinct languages known to exist, few have been studied scientifically. The most widely distributed is the Malay, which has not only been diffused by the Malays themselves throughout the coast regions of the various islands, but, owing partly to the readiness with which it can be learned, has become the common medium between the Europeans and the natives. The most cultivated of the native tongues is the Javanese, and it is spoken by a greater number of people than any of the others. To it Sundanese stands in the relation that Low German holds to High German, and the Madurese in the relation of a strongly individualized dialect.

The statistics of the population are, with the exception of those for a few limited areas, such as Java, of the most unsatisfactory character. The estimate of Behm and Wagner in 1880 has been already stated—34,813,000.

Politically the Indian archipelago is subject to a sixfold division:—The independent native states and tribal territories, the Spanish possessions, the Portuguese possessions, the Dutch possessions, the English possessions, and the state of Sarawak. The Dutch are by far the most influential power in the archipelago. The Spanish authority is confined to the Philippines and the Sulu archipelago—the latter rendered tributary to them by the native sultan in August, 1878, in return for an annual subsidy of \$2,400. The English, if the island of Singapore be considered as belonging rather to the Malacca Peninsula, possess only the island of Labuan (19,350 acres), acquired in 1847, though the establishment of

the British Bornean Company in the north of the island may prove the beginning of a new acquisition. To the Portuguese are subject part of Timor and the island of Kambing, in all 6,192 square miles. The Dutch on the other hand claim, besides an area of 149,820 square miles in western New Guinea, a total territory in the archipelago of 566,383 square miles, or forty-four times as much as the governing country. Of the really independent native states the largest is that belonging to the sultan of Brunei (Borneo); it is estimated to have an area of about 88,000 square miles.

INDIANAPOLIS, the capital of Indiana, is situated at almost the exact geographical center of the State, 824 miles west of New York by rail, and 194 miles southeast of Chicago. It stands 721 feet above the sea-level, and 148 above Lake Erie.

On the admission of Indiana as a State into the Federal Union in 1816, Congress presented four square miles of public lands for its seat of government, to be selected by the State. The location was made in 1820 at the confluence of Fall Creek and White River. The site chosen was in the midst of the unbroken forest, sixty miles distant from the borders of civilization, and only reached by Indian trails. The name Indianapolis was given by an act of the Legislature on January 6, 1821; and Alexander Ralston was appointed to lay out the city. Selecting a slight mound near the middle of the ground as the center of the proposed capital, Ralston laid out the town after the manner of Washington city, which he had helped to survey.

Four avenues radiate from the center to the four corners of the city. The streets and avenues are 90 feet wide, except Washington, the main street, which is 120. The city has now outgrown its original limits, and extends four miles in length and three in width. It is built upon a level plain and surrounded by a fertile country. It was incorporated in 1836, and received a city charter in 1847. Its growth is shown by the following table:—

Year.	Population.	Assessed Value of Property.
1850	8,090	\$2,326,185
1860	18,113	10,700,000
1870	48,244	25,981,267
1880	75,121	50,254,934
1890	105,436	53,000,000

In 1847 the first railway entered the city. Within a few years thereafter other lines were constructed, until now fifteen main lines converge there. The numerous tracks being on a level with the surface of the streets, the obstruction and danger at the numerous crossings became very great on account of the increase of railway traffic, so that in 1877 a loop line, called the "Belt," had to be made passing around the city, to connect the various railroads. By means of it the "through freight cars" are conveyed past the city without blocking the traffic.

Indianapolis is in the center of the swine-producing region, and pork packing is one of the chief industries of the city. It is also largely engaged in the grain trade. The railways have been of greatest service to Indianapolis, compensating for its want of water transit. The manufacturing and mercantile interests, which are large and increasing, are the natural result of the city's extensive railroad connections.

A system of graded free schools is maintained all the year. The city school property is valued at \$1,041,000.

In 1871 a public library was established, and is supported by taxation. It now contains 36,461 volumes, and is

rapidly increasing. The Masonic temple, Oddfellows' hall, postoffice, United States arsenal, and chamber of commerce are handsome buildings. The Marion county court house, standing on a public square in the heart of the city, was completed in 1877 at a cost of \$1,411,524. The exterior is of Indiana limestone, the interior of iron and marble, with frescoed walls and ceilings. Its dimensions are 150 by 286 feet, and 240 feet to the top of the dome. The principal benevolent institutions of the State, viz., the institution for the education of the blind, that for the deaf and dumb, and the hospital for the insane, are located here; they are handsome and commodious buildings, the last having accommodations for 1,313 patients. The State reformatory for women and girls, where all female offenders are imprisoned, adjoins the city. The institution is under the management of a board of control, composed of women chosen by the governor of the State. In 1877 the State began the erection of a new State house, completed recently at a cost of \$2,000,000. The city is well lighted and paved, and has water-works, three public parks, a complete system of street railroads, some thirty-five hotels, five national and two State banks, nine weekly and six daily newspapers, ninety churches and over sixty schools.

INDIAN CORN. See MAIZE.

INDIAN OCEAN. This designation is given to the portion of the oceanic area which extends northward from the great southern water-zone, between the eastern coast of South Africa and the western boundary of the partially submerged Malayo-Australian continent. But while the Atlantic and Pacific extensions from the southern water-zone—the one dividing South Africa from South America, and the other forming the wide expanse of ocean between the western coast of South America and the eastern side of the Malayo-Australian continent—are prolonged into the land hemisphere as far as the north polar area, the Indian Ocean does not extend itself northward beyond the Tropic of Cancer, where it is abruptly closed in by the great land mass of the Asiatic continent. The northwestern boundary of its basin is formed by the southeastern coast of Arabia, its northeastern by the western coast of Burmah. But, between these two parts of its border, its basin is encroached on by the southward projection of the Indian peninsula, and is thus divided into two deep gulfs, of which the western is distinguished as the Arabian Sea, and the eastern as the Bay of Bengal. Now, looking to the fact that these gulfs must have been united, at no remote period, by a transverse band of sea, covering what is now the continuous alluvial plain of Northern India, we may consider the real northern border of this basin to be the great Himalaya range, the southern slope of which must have once formed its shore-line. It is remarkable that nearly the whole of its land-border is of considerable elevation, being formed on the west by the mountainous ridge that flanks the great table-land of South Africa, on the northwest by the corresponding ridge which forms the southeastern border of the elevated plateau of Arabia, while near its eastern margin there is a nearly continuous mountain range, that extends southward from Assam to the extremity of the Malay Peninsula, and is thence prolonged through Sumatra and Java.

The Indian Ocean has no definite southern limit, but is considered to terminate at the parallel which stretches between the southernmost points of the African and Australian continents, near which, about midway between these two extremes, lie the volcanic islands of St. Paul and Amsterdam. The Indian Ocean is often spoken of as divided by the equator into a northern and a southern portion.

The main basin of the Indian Ocean has an average depth of about 2,500 fathoms, increasing to 3,000 fathoms in the angle between Java and northwestern Australia, which is the deepest part of it yet sounded. Its southern border is formed by a submarine plateau, which rises in some parts to within 1,500 fathoms of the surface, and which forms the common foundation, not only of the islands already mentioned, but also of the Crozets, the Kerguelen group, Prince Edward's Islands, and the Heard Islands, all of which seem to have had a volcanic origin. This plateau, however, does not shut in the southeastern portion of the basin; for a southward extension of the depression already described follows the trend of the western and southern coasts of Australia and the western coast of Tasmania, and is continuous with the deep channel (in some parts exceeding 2,500 fathoms) between Australia and New Zealand. The western and northwestern parts of the basin, on the other hand—as the number of their island-groups would lead us to anticipate—have a much less uniform depth. In the first place, the western border of the basin is encroached on by the great island of Madagascar, which must be considered as an outlying extension of the continental platform of South Africa, the Mozambique channel being comparatively shallow; and, although the bottom, at no great distance from its eastern coast, rapidly deepens to 2,000 fathoms or more, yet this is only in a channel that separates Madagascar from a platform of about half that depth, on which are based the volcanic Mascarene Islands (Mauritius, Bourbon, and Rodriguez), and of which a northern extension forms the base of the Seychelles group. This platform then curves to the southwest, so as to pass around the north of Madagascar, forming the base of several coral islands, and thus comes into continuity with the bed of the Mozambique Channel, from which the Comoro group arises. To the north of this platform, the 2,500 fathom line follows the trend of the African coast as far as Cape Gardafui, keeping outside the island of Socotra; and a bottom of more than 2,000 fathoms (crossed by the telegraph-cable between Aden and Bombay) extends into the Arabian Sea as far as 15° N. latitude. On the eastern side of that gulf, however, the declivity from the Indian coast-line to the deepest part of the basin is much more gradual; the Maldive and Laccadive groups of coral islands rising from a comparative shallow, which extends itself a little to the south of the equator. And about half way between this platform and that of the Seychelles the bottom rises into the bank which bears the Chagos archipelago, and which divides the communication between the deeper portion of the general basin and that of the Arabian Sea into two channels of no great width. Though the 2,500 fathom line does not enter the Bay of Bengal, a considerable portion of it has a depth exceeding 2,000 fathoms. Here, again, the declivity is more gradual along the eastern margin of the gulf; and the Andaman and Nicobar Islands arise from a comparatively shallow platform that stretches between the delta of the Irawadi and the north end of Sumatra.

Currents.—The current-system of the Indian Ocean is clearly dependent upon the winds which prevail over its several parts—the seasonal reversal of the monsoons in the northern part of its area producing a corresponding modification in the direction of the surface-movement of its water, while in the southern division the constancy of the southeast trade-wind keeps up through the whole year a strong westerly equatorial current. The northeast monsoon has, of course, while it lasts, the same effect as a northeast trade-wind would exert, in producing a general southwesterly drift over the northern division of the Indian Ocean, which manifests

itself in a southerly flow along all the shores it meets, viz., the southeast coast of the Indian peninsula, the southeast coast of Arabia, and the east coast of Central Africa. Besides this, a special current-movement is produced by the action of the northeast monsoon on the surface-water of the China Sea, by the drift of which to the southwest it is forced into the channel between the Malay Peninsula and Sumatra, whence it issues into the Indian Ocean, through the Strait of Malacca, as a current that crosses the Bay of Bengal and impinges against the Coromandel coast of India. By this it is deflected southward, along with the general drift already mentioned, and then courses round the southern angle of the great peninsula—partly between Ceylon and the mainland, and partly along the outer coast-line of Ceylon—into the Arabian Sea, where it merges into the general drift of the surface-water toward the African coast. The average rate of this current, as it issues from the Strait of Malacca, is thirty miles per day; along the southeast coast of India, twenty-four miles; on the east coast of Ceylon, forty miles; and along the Arabian coast, eighteen miles. But when the northeast gives place to the southwest monsoon, about the vernal equinox, the whole of this movement is reversed. The drift then commences from the African and Arabian coasts, and sets across the Arabian Sea, at the rate of about twenty-four miles a day, to the Malabar coast of India, along which a current flows in a southerly direction at the rate of about thirty miles a day. This current rounds Cape Comorin and the southern coast of Ceylon, where it sometimes attains the rate of forty-five miles a day, and passes into the Bay of Bengal, reënforcing the general northeast movement of its own water, circulating round the head of this gulf, and then undergoing a deflection by the coast-line toward the entrance of the Strait of Malacca, into which it flows at the rate of from twenty to twenty-four miles per day. When the sun crosses the equator toward the south at the autumnal equinox, so that its heating power is exerted on South Africa, the indraught of air toward that continent reproduces the northeast monsoon; and this restores the westerly drift, which extends over the Indian Ocean as far as 5° S. latitude, giving place at about that parallel to the equatorial counter-current.

The surface of the southern Indian Ocean, between the parallel of 10° S and the Tropic of Capricorn (the precise limits varying with the season), is pretty constantly traversed by the southeast trade-wind, which gives a steady westward movement to its water, known as the south equatorial current, whose average rate is about fourteen miles per day. This meets the eastern coast of Madagascar, and that of continental Africa to the north and south of it; and, its onward flow being thus checked and deflected southward by the trend of the land, it forms a strong current which sets along the Natal coast toward Cape Colony. The strength of this current varies according as the northeast or the southwest monsoon is blowing; for the movement produced by the former reënforces it, while that produced by the latter weakens it, by deflecting northward a portion of the water which the southern equatorial current brings to the coast of Africa, and drifting it toward the Indian peninsula. When flowing with its greatest force and velocity, the Natal current is scarcely, if at all, inferior to the Gulf Stream where it issues from the Florida Strait. When passing Cape Corrientes, at the southern extremity of the Mozambique Channel, it is said to have a rate of eighty miles per day and has been even said to rush, under a rare combination of impelling forces, with a velocity of 140 miles per day. Its rate gradually diminishes, however, until, off Cape Colony (where it is known as the Agulhas current), it has a

velocity of about fifty miles per day. The warmth it carries has a very important influence in ameliorating the climate of Cape Colony; for this would otherwise suffer from the importation of the low temperature brought by the Antarctic current which there meets it. When the Agulhas current is at its strongest, it carries a temperature of 79° as far west as the meridian of 15° E. But when the drift of the monsoon wind counter-veils that of the southeast trade, instead of reënforcing it, the temperature of the Agulhas current is lower and its force less. While a portion of this current rounds the Cape and becomes a tributary of the South African current of the Atlantic (thus carrying away the excess brought into the basin of the Indian Ocean by the Malacca current), the principal part of it is deflected to the south and east, partly by the agency of the Antarctic current, but chiefly under the influence of the westerly winds or "anti-trades," that prevail throughout the southern water-zone which almost continuously girdles the globe between the parallels of 40° and 60° S. Thus there is here a pretty constant retrograde set of surface-water (corresponding with the southern connecting current of the South Atlantic), at the rate of about twenty-four miles a day, toward the western coast of Australia; and since, notwithstanding the reduction of its temperature, the water which has circulated in the Indian Ocean is still much warmer than that which forms the general mass of the easterly drift, it is probably through this excess (imparting a corresponding excess of vapor to the atmosphere above, which is condensed again by contact with the colder land) that the fogs are generated, for which the islands that lie in the course of this flow are notorious. On arriving at the shores of Australia, this drift is divided by the southwest projection of its coast-line into two streams, one of which continues its eastward course along the southern coast, while the other, turning northward, forms the West Australian current, of which the greater part, when it reaches the head-water of the southern equatorial current, is drawn into it, and thus completes the circulation of the southern Indian Ocean.

Between the parallel of 5° , to which the influence of the monsoon winds extends, and that of 10° S., which is the usual northern limit of that of the southern trade, there is a "belt of calms," wherein there runs an equatorial counter-current, which corresponds to that of the Atlantic ocean, and is, like it, to be considered as a back-water flowing toward the source from which the currents to the north and south of it derive their supplies.

INDIANS, AMERICAN. The application of the name Indians to the native peoples and tribes of the New World is an erroneous usage, originating in the belief of the Spanish discoverers of America that they had reached the eastern shores of Asiatic countries already partially known. As it happens, the name is now, even apart from the addition of American, customarily applied to the aborigines of the western hemisphere, while it is used with far less frequency as a collective name for the inhabitants of the great country of the East known from the remotest time as India.

It may be asserted with some confidence that there is nothing in the physical and mental condition of the aboriginal Americans which requires us to postulate for them a foreign origin. If man was evolved originally from several centers, America assuredly included one at least; if he sprang from a single pair, then we can even conceive that pair to have been first established in the New World, and the arguments brought forward in support of an Asiatic origin of the American would not lose their point if adduced in favor of an American origin of the Asiatic peoples.

Andreas Retzius, the founder of scientific craniology, arguing on insufficient materials, grouped all the American aborigines in two great divisions—(1) a western or highland, occupying the main ranges of the Rocky Mountains and Andes, with the intervening lands thence to the Pacific; and (2) an eastern, mainly lowland, whose domain stretched from the western uplands to the Atlantic seaboard. The former, being characterized by brachycephalous or round heads, he felt disposed to connect with the brachycephalous Mongolians and Malays of Asia and Australasia. The latter, being of a decided dolichocephalous or long-headed type, he traced to possible Berber and Guanche migrations from northwest Africa and the Canary Islands, doubtless because the historical arrival of the dolichocephalous Norsemen in the New World was of too recent date to serve his purpose. But Virchow has amply shown that this classification is untenable, and it will be seen further on that there are long and round-headed types often intermingled in every part of the continent. Virchow himself, while denying the claim of the American race to be considered autochthonous, declines to commit himself as to the probable regions whence they may have reached their present habitat. The theory of an Asiatic immigration *via* Behring Strait has been somewhat revived since ethnologists have, so to say, rediscovered the lost Tchuktchis of the northeast coast of Siberia through Nordenskjöld's Swedish polar expedition of 1878-79. These Tchuktchis are supposed to form the connecting link between the races of the two worlds, and the supposition is strengthened by the *invention* of an American branch of the tribe. Professor Nordenskjöld himself remarks that "this race, settled on the primeval route between the Old and the New World, bears an unmistakable stamp of the Mongols of Asia and Eskimo and Indians of America." But Lieutenant Palander of the same expedition says that "they undoubtedly descend from the Greenland Eskimo," which would at once deprive them of all value as a connecting link, while Peschel much more probably allies them to the Itelmes (Kamtchadales), the two languages being "as closely related as is Spanish to Portuguese." W. H. Dall further points out that the Innuit (Eskimo) tongue, said to be spoken by the Tchuktchis, is merely a trading jargon, a mixture of Koriak, Tchuktchi, Innuit, English, Hawaiian, and others. It is also to be noted that the Samoyedes and other Asiatic Arctic peoples, assumed by many to be the progenitors of the Eskimo, are of Mongoloid stock and distinctly brachycephalous, while the Eskimo are the most dolichocephalous race on the globe next to the Kai Colos of Fiji. Thus the Eskimo, instead of being a connecting link, form an anthropological barrier between the populations of the two hemispheres at the very point geographically most convenient for effecting the transition.

Nor would the question be much furthered by allowing the arrival of a few barbarous tribes *via* Behring Strait in prehistoric times. Their presence would leave the Aztec, Mayan, Peruvian, and other local cultures unexplained, except as independent developments. And more recent historic migrations of Chinese, Japanese, and other civilized people, otherwise involved in tremendous difficulties, would leave equally unexplained the primeval mound-building races of the Ohio valley and the still more ancient Brazilian races of the Santa Catharina and Santos shell-heaps. Because a stray vessel has been cast ashore on the western seaboard since the discovery of America, Virchow suggests the possibility of similar arrivals in remoter times. But if the Chinese arrived so recently as even 8,000 years ago (an extreme supposition) in sufficient numbers to build up a

civilization in Central America, the Chinese origin of such a civilization would to this day be as self-evident as is the Chinese origin of the neighboring Japanese civilization. The foreign founders of these communities would necessarily have brought with them their arts, their domestic animals, their more useful plants and cereals, without which they must have themselves speedily perished or been absorbed in the surrounding native populations. But no trace of these things was found in the New World on its discovery. There was neither the rice of the Chinese, nor the wheat, barley, oats, or rye of the western nations, nor the iron now proved to have been known to the ancient Assyrians and Egyptians, nor the horse, camel, ox, sheep, pig, dog, or poultry of the eastern hemisphere. Instead of these, there was little beyond one cereal (maize), one esculent root (potato), one feeble beast of burden (llama), limited to the uplands of the southern Cordilleras, one species of dog elsewhere unknown. Most of the useful plants and animals of the East have since been introduced, and flourish vigorously even in the wild state, a sufficient proof that they would have been propagated had they been introduced at an earlier epoch. The knowledge of metals was limited to copper, both wrought and, in Wisconsin, apparently cast (J. S. Butler), bronze, lead, gold and silver. Otherwise most of the nations were at the discovery still in the Stone Age; and, although Virchow's assertion may be true that the most practiced archaeologist will fail to detect any material difference between the stone implements of the two hemispheres, this merely implies that the arts of Palæolithic and Neolithic man were pretty much the same everywhere.

Nor is there anything in the religions, systems of government, architecture, and other arts of the native Americans, by which they can be connected with the corresponding systems of the East. That the Toltec builders of the low obtruncated Mexican pyramids were a different people from the pyramid-builders of the Nile valley, and that the mummies of the Ancon necropolis and other parts of Peru were of a different stock from the Egyptian mummies, is sufficiently evident from the texture of the hair alone. The hair of the old cultured races of America was the same as that of all the later American races, uniformly lank, because cylindrical in section. The hair of the old Egyptians, like that of the modern Fellahin, is, on the contrary, uniformly wavy, because more or less oval in section. The religions, again, of the Red Man, we are told by Carl Schultz-Schlack, Oscar Loew, and other good observers, are "essentially astrological, based on star, sun, and moon worship, with which was often associated an intricate method of measuring time built on a series of twenty constellations." "The sun," says Loew, "is the god of most Indian tribes. 'He diffuses warmth and nourishment for us and our animals; why shall we not worship him?' observed to me on one occasion Masayamtiba, a Moqui Indian (New Mexico)." This Masayamtiba was a better philosopher than those ethnologists who seek for the origin of such a simple cult in the remote corners of the globe, rather than in the beneficial influence of the heavenly bodies which shine alike for all mankind. The four great gods of the Mayas, the "props of the heavens," answered to the four great Mexican gods of the four quarters of the compass, all being associated with the four elements of wind, water, fire, and earth. But to what does either system answer in the polytheistic creeds of the Hindus, Assyrians, Babylonians, or other nations of antiquity? There is something similar in the Neo-Buddhistic teachings; but Buddhism, even of the oldest type, is much too recent to explain anything in the religious worlds of Mexico or Yucatan. The hare is

associated in America, in Asia, and even among the Bushmen of South Africa with the moon. But this association was obviously suggested independently by the spots which, especially in the first quarter of the moon, seem to present the outlines of a hare on its form. Waitz well observes that a common belief in a universal flood, or in the periodical destruction of the world, whether by fire, water, storms, or earthquakes, and analogous or parallel lines of thought—taken individually—afford no proof whatever in favor of affinity, and even resemblances in several points possess only a secondary importance; for they may partly, under like conditions, arise spontaneously among peoples who have always lived in a state of separation, or may have partly resulted from periods of short intercourse between two different peoples.

In any case, these slight coincidences are of little account when weighed against the argument based on diversity of speech. The tremendous force of this argument, as applied to the American aborigines, is scarcely realized by anthropologists such as Waitz or Virchow, who have not cultivated philological studies, and it is significant that, in the already quoted paper by Virchow on the "Anthropology of America," the linguistic element is not even referred to. On the other hand, it has been greatly depreciated and even brought into contempt by the vagaries of certain etymologists, who discover affinities where there is nothing but the vaguest verbal resemblance. Science has demonstrated beyond all cavil that, while differing widely among themselves, the American languages not only betray no affinity to any other tongues, but belong to an absolutely distinct order of speech. They are neither isolating nor monosyllabic like the Indo-Chinese group, agglutinating like the Ural-Altaic, Bantu, or Dravidian, nor inflectional like the Semitic and Aryan. They come nearest in structure to the Basque, which is the only incorporating language of the Old World, but differ from it essentially, inasmuch as their capacity of incorporating words in the sentence is not restricted to the verb and a few pronominal elements, but extends in principle to all the parts of speech. This faculty, which, with one or two doubtful exceptions, seems to be characteristic of every American idiom from Behring Strait to Cape Horn, has received the name of polysynthesis, literally "a much putting together." Hence, in a comprehensive classification of articulate speech according to its inner mechanism, a special place must be reserved for the American group.

We do not intend to imply that American derives from Malayan or Dravidian, but only from some now extinct agglutinating forms of speech of which Malayan or Dravidian may be taken as still surviving typical instances. The disappearance in America of all such assumed forms, unless the Otomi of Mexico is to be accepted as a solitary lingering specimen, argues both a very great antiquity and an independent evolution of the American languages. And as the course this evolution has taken differs entirely from that pursued by the idioms of the Old World, it follows that the first peopling of America, if from the Old World, must be thrown back to a time when all speech itself was in its infancy, to a time when slow diffusion might be conceived as equally probable from an eastern or a western starting-point. It is this feature of a polysynthesis that gives the American race its first and greatest claim to be regarded as truly autochthonous, in the same sense that we regard the Mongolian and Caucasian races as truly autochthonous in Asia.

There is a general consensus among anthropologists that on the western continent we are in presence of two distinct original types, the brachycephalous and

dolichocephalous. But these are no longer confined to separate geographical areas, as Retzius supposed. The very general practice of artificially flattening or otherwise deforming the skull has naturally caused less value to be attached to the craniological test in America than elsewhere. The practice has been traced back even to prehistoric times, and a clay figure recently found associated with the remains of a child by Reiss and Stübel in a grave in Ancon puts in a clear light the method adopted by the ancient Peruvians. Still, careful investigations have placed it beyond doubt that the normal skull both in North and in South America is now mesaticephalous, or of a type intermediate between the two extremes, a fact supposed to imply a general intermingling of the two primeval stocks. On the other hand, Virchow shows perfectly normal ancient and recent crania from both sides of Greenland, from El Carmen on the Rio Negro, Patagonia, from the Botocudo tribe, East Brazil, from a tumulus of Santa Fé de Bogota, and even a Peruvian mummy exhumed at Pancatambo, all of which are distinctly, in some cases extremely, dolichocephalic. In the same way he produces brachycephalic skulls from the Brazilian shell-mounds of Santos and Santa Catharina, from the barrows of the Ohio valley mound-builders, from the Carib and Araucanian tribes, and from the Pampas of La Plata, the last mentioned of an extreme type, in close proximity to the extreme dolichocephalous specimens from Patagonia. Were it safe to argue from the analogy of Britain, where the dolichocephalic builders of the long barrows seem to have preceded and afterward become intermingled with the brachycephalic builders of the round barrows (Doctor Thurman), the western continent might be supposed to have been successively occupied first by a long-headed and then by a round-headed race, which kept aloof in a few places, while more generally becoming fused in a normally mesaticephalic type. But we have in America no guide to the relative priority of the two forms of head, nor are there now any long-headed races on the eastern Asiatic seaboard whose ancestors might be taken as the precursors of the corresponding element in the West. The obvious alternative also remains, that the two forms may have become differentiated on the American continent, just as similar differentiations must, by those who do not accept the doctrine of fixity of species, be assumed to have taken place in Asia. For such an evolution America offered a more ample field even than Asia, for it is not confined to the northern hemisphere, but stretches from the Arctic nearly to the Antarctic Circle, presenting in this wide range almost every conceivable variety of climate, atmosphere, soil, and temperature.

We thus see that the two cranial forms do not necessarily militate against the possible primordial unity of the *homo Americanus*. This unity seems on the other hand implied in certain physical and mental features, common to all the native races. Of the physical traits the most important and uniform are—(1) the hair, which is always black, coarse, glossy, and long, like a horse's mane, round in transverse section and persistent to extreme old age; (2) slight beard, but always straight, never wavy; (3) eyes small, black, somewhat deep-set, always horizontal; (4) eyebrows narrow, very arched, and black; (5) prominent cheek bones and nose, the latter often very long and aquiline.

The native American being popularly spoken of as "The Red Man," it might be supposed that color should be included in this brief list of common characteristics. But, notwithstanding the general impression, there is perhaps no other region of the globe where so great a variety of color prevails. The more general tints are a copper or cinnamon brown, and olive yellow; but different

tribes, grouped according to their color, show that the extremes of a deep brown, almost approaching a true black, and of a light or fair hue, almost approaching a true white, also occur, altogether independently of latitude, climate, or elevation of the land.

The same applies to stature, varying from the dwarfish Eskimo, Fuegian (mean five feet one inch), and Peruvian (mean four feet nine inches) to the gigantic Patagonian, the tallest race on the globe.

No less varied are the other physical traits, while the wide divergence of mental capacity is sufficiently indicated on the one hand by the Cherokees of the southern Alleghanies, who in 1824 invented a complete syllabic writing system, and who can reckon to a million and upward, and on the other by the Chiquitos of the Bolivian lowlands, who, D'Orbigny assures us, "cannot get beyond one (tama), after which they have nothing but terms of comparison." The only real intellectual faculty common to all the American races is that implied by the peculiar polysynthetic mechanism of their speech. But beneath this general morphological structure, the substance of the languages themselves varies greatly in all that concerns their phonetic systems, vocabularies, relational forms, syntax, and methods of combination. While, for instance, the Thlinket of the extreme northwest Pacific seaboard, the Apache of Arizona, the Quichua of Peru, and the Aymara of the Bolivian uplands are among the very harshest and most guttural tongues in the world, the Otuke of the Bolivian plains, the Mohave of Arizona, the Chiquito of the upper Paraguay basin, the Samucu on the north frontier of Gran Chaco, and many Amazonian dialects are distinguished by great softness, often rivaling in euphony the most musical languages of the eastern hemisphere. The linguistic families differ from each other, not only in the measure to which their polysynthesis has been developed, but even in its very character, so that while some have scarcely yet arrived at a clear differentiation of verb and noun, others, like the Iroquois, have a purely verbal, others again, such as the extinct Timucua of Florida, an exclusively nominal inflexion. In the same way some are partial to prefixes, some to suffixes, some to infixes. Many of the Californian idioms seem to be still verging on the agglutinating stage, while the just-mentioned Timucua, the Aztec, Choctaw, Shoshone, Cree, Matlalzinca, and others of the Anahuac table-land, have reached the very acme of polysynthesis, in which all the parts of the sentence often become by indefinite composition and syncope fused into one interminable "bunch-word" of from ten to fifteen syllables and upward. As these languages also differ entirely in their vocabularies, often possessing not a single root in common, it follows that they can be no more classed together than can for instance the various agglutinating tongues of the Caucasus or the Soudan.

It thus appears hopeless to look for any unity of details in the mental and physical faculties of the American aborigines. What they have in common is reducible to one physical and one mental quality, the universal texture and black color of the hair, and their polysynthetic speech. These two properties point directly at primordial unity of origin; the endless varieties of detail argue a prodigious antiquity and an independent development of the race on the American continent. The variety renders the work of classification a labor of extreme difficulty and uncertainty. Amid all these endless points of divergence, it seems impossible to find any common basis round which to group the various tribes and races, and the problem becomes further complicated by the fact that, while many of these tribes differ in speech, though evidently of one racial stock, others belonging to the same linguistic connection present the

widest physical discrepancies. Within comparatively narrow areas occurs occasionally every conceivable element of confusion, as in California and the southwestern States, occupied by the morally debased and physically degraded Pah-Utes, the tall and manly Mohaves, the ferocious Apaches, the mild and intellectual Indians of the New Mexican Pueblos, some fishers and hunters, some living on roots and berries, some skilled agriculturists, all speaking fundamentally distinct languages.

It is evidently impossible in such a case to adhere throughout to any one method of classification, and the following tentative survey is consequently based partly on the linguistic and partly on the ethnical elements, but partly also on mere geographical grounds. Fortunately there are in all the divisions of the continent a few great families, occupying vast regions, in which the ethnical and linguistic elements largely coincide. Foremost among these are the sub-arctic races and the Athabascans, Algonquins, and Dakotas in the north, the Maya-Quiché in the center, and in the south the Caribs, Quichua-Aymaras, and Guaranis. These eight stocks cover jointly an area of not less than 11,000,000 of square miles, with a total aboriginal population of about 4,000,000. But the 7,000,000 of pure and mixed Indians occupying the remainder of the land, 5,000,000 of square miles in extent, are divided into a multiplicity of tribes, whose racial and linguistic affinities present problems the solution of which must long tax the utmost ingenuity of science. The total number of distinct languages alone is estimated at about 760, of which 430 are in the north and 330 in the south. In the northern division Balbi reckons, exclusive of California, thirty-two stock languages, far too low an estimate, while Rivero and Tschudi consider that of the southern idioms as many as four-fifths are radically distinct. But all such calculations are mere vague guesses at the truth; and in the present state of our knowledge it is impossible to form an estimate of the actual number of languages still current in Gran Chaco, Chiquitos, the Amazon valley, Central America, Mexico, California, the Columbia basin, regions where an extraordinary complexity of speech prevails. Nevertheless language forms on the whole perhaps the most convenient basis of classification, and without its aid it would have been impossible to determine the affinities of many wide-spread races, such, for instance, as that of the Arizona Apaches with the Canadian Chippewayans, or on the other hand to separate nations apparently closely related, like the Iroquois from their Algonquin neighbors, or the Araucanians from the Peruvians. The true relations of many tribes are, on the other hand, still doubtful, because of uncertainty regarding the languages they speak. Such are the Cheyennes, Blackfeet, and Arapahoes, classed by some with the Dakotas, by others more probably with the Algonquins. Such also are the so-called Diegueños of South California, oscillating between the Shoshone (Snake) and Yuma connections, and the Pawnees of Nebraska and Kansas grouped by Bancroft with the Shoshone, but by Morgan regarded as an independent race. So close is the physical resemblance in these and many other cases that the question must ultimately be decided by a more exhaustive study of their languages.

MODERN HISTORY AND PRESENT DISTRIBUTION OF NORTH AMERICAN INDIANS.

It is only very recently that the number of Indians on the North American continent has come to be known with any degree of accuracy. The best estimates at present accessible, based on the reports of Indian agents and on the United States census for 1880, give the total number in the United States as 303,248. The number in British North America is estimated, more roughly, at

103,969, making a total for the continent, north of Mexico, of 407,217. The following table, which is compiled from the census returns for 1880, may be relied on as approximately correct:

BRITISH POSSESSIONS.			
Ontario.....	15,941	Kansas.....	693
Quebec.....	12,054	Louisiana.....	807
Nova Scotia.....	2,126	Maine.....	603
New Brunswick.....	1,433	Massachusetts.....	341
Prince Edward's Island.....	266	Michigan.....	17,045
Manitoba & N. W. Ter... ..	30,227	Minnesota.....	17,893
Athabasca.....	2,398	Mississippi.....	1,811
British Columbia.....	35,154	Montana.....	20,825
Rupert's Land.....	4,370	Nebraska.....	4,494
Total.....	103,969	Nevada.....	7,728
UNITED STATES.		New Mexico.....	22,860
Alabama.....	170	New York.....	5,820
Arizona.....	24,753	North Carolina.....	1,152
Arkansas.....	144	Oregon.....	5,854
California.....	16,581	Pennsylvania.....	156
Colorado.....	4,316	South Carolina.....	113
Connecticut.....	230	Tennessee.....	238
Dakota.....	31,707	Texas.....	869
Idaho.....	6,248	Utah.....	1,166
Illinois.....	104	Washington.....	16,786
Indiana.....	186	Wisconsin.....	10,340
Indian Territory.....	78,142	Wyoming.....	2,272
Iowa.....	801	Total.....	303,248
		Grand total in N. America.....	407,217

The popular idea has always been that these races are fast disappearing, and that their total extinction is merely a question of time. This conclusion has recently been called in question by Col. Garrick Mallory, of the United States army, in a paper read before the American Association for the Advancement of Science. From the evidence he presents it appears that, while many tribes have decreased in number, and some have even become extinct, others have increased very decidedly, leading to the probable conclusion that the Indian population of North America as a whole has not decreased greatly since the earliest occupation of the country by Europeans. It is at least certain that the Indians have been brought under various influences which tend to prolong and preserve life. The murderous inter-tribal wars have ceased; the people are now better housed, clothed, and fed; many of them have regular vocations; and they have medical attendance when sick.

The general policy of the United States government, in its management of the Indian tribes within its borders, has been to treat with them as separate but subject principalities. It thus makes treaties with the different tribes, purchases land from them, etc. Its policy further is to place all the tribes upon reservations, whence they are prohibited from wandering, and which are forbidden ground to whites, thus isolating them from the rest of mankind. In return for land ceded by them to the United States most of the tribes receive yearly grants, which are paid in the form of supplies of food, clothing, arms, and ammunition. Under such conditions, the experiment of civilizing them is being attempted—in the case of some tribes with success, in others, thus far, with utter failure. As, however, all stimulus to self-support is wanting, it seems surprising that any tribe should have made perceptible advance at all, and the progress attained is therefore encouraging for future effort. The policy of the Dominion Government is almost precisely similar to that of the United States, but the results are very different in the two countries. While the United States have had almost continual trouble with their aboriginal inhabitants, Canada has had no Indian difficulties of importance. This is due in part to a difference in the practical working out of the policy, but more to differences in environment. The Indian service of the Dominion Government is composed of a trained body of men, who remain in it through life, who thoroughly understand the Indian character, and

who become known and trusted by their charges. The members of the United States Indian service, on the other hand, are appointed by political or church influence, and are in many cases unfit for the work; they are changed also as the balance of political power passes from one party to another. The Dominion has always fulfilled the conditions of its treaties, and has always administered punishment promptly and severely when the necessity arose. The United States have broken treaty after treaty, or have neglected to fulfill their obligations to such an extent that most tribes no longer have confidence in the promises of the government. In cases of outrages by Indians, it has, as a rule, been very slow and dilatory in punishment.

But undoubtedly the principal reason for the immunity the British Possessions have hitherto enjoyed from Indian wars lies in the fact that the Indians have not yet been crowded by the whites. While the area is larger than that of the United States, the Indian population is but about two-fifths as great, and the whites are but one-tenth. The Indians still hold their favorite hunting and fishing grounds; the game and fish have not yet sensibly decreased; and the whites do not yet so press upon them as to arouse their jealousy and suspicion. The history of the Indian tribes in the United States, from the time of the first occupation of the country by the whites, has been one of forced migrations, always westward, to make way for the repeated encroachments of civilization. As the result of a succession of disastrous wars and forced treaties, nearly all the aboriginal population formerly living east of the Mississippi has either been destroyed or removed beyond that river. In the British Possessions they have been more fortunate. The first settlements in the provinces were made by the French, who associated freely with the natives, intermarrying to a large extent. This produced a bond of union between them, the effects of which, in both peoples, are to be seen to the present day. The country being still but thinly peopled, the necessity for removing the Indians, in large numbers, has not yet arisen; and their treatment by the Dominion Government has been more humane and just than in the United States. In consequence of all this, most of them remain in or near their original homes. Excepting those tribes which have moved across the border from the United States, few, if any, have engaged in war against the whites. As long as the western country was the domain of the Hudson's Bay Company the interests of the traders were, to a large extent, identical with those of the natives. The Company furnished a ready market for furs and pelts, of which the Indians were quick to avail themselves; indeed, although it supported a large number of French trappers, by far its principal business was done with the natives.

INDIANS IN THE DOMINION OF CANADA.—The general distribution of the tribes of the British Possessions is as follows: In the province of Ontario are found parts of the Six Nations, Wyandots, Chippewas, Minsees, Mississaugas, and others of Algonquin stock. In the province of Quebec are another part of the famous Six Nations, besides Abenakis, Montagnais, Micicetes, Micmacs, and other smaller tribes. In Nova Scotia and Prince Edward's Island are Micmacs, in New Brunswick a part of the same tribe and a few of the Micicetes. In Manitoba and Northwest Territory, the Chippewas, Crees, Blackfeet, and Dakotas make up the aboriginal population. The Athabasca district is peopled by the Crees, Assiniboines, Chippewayans, and Beavers; while British Columbia and Rupert's Land contain a great number of small tribes, too numerous to be mentioned here.

INDIANS OF THE UNITED STATES.—Of the numer-

ous and powerful tribes which inhabited New England at the time of its first settlement, but few fragments remain.

A remnant of the once powerful *Penobscot* tribe is settled at Oldtown on the Penobscot river, in Maine, and in other parts of that State and in Massachusetts, and fragments of other tribes still exist.

The *Pequod* and *Mohegan* tribes were among the largest and most powerful. Their range was central Massachusetts and Connecticut. During the settlement of those States, these Indians were removed to western New York, where they rapidly became civilized and prosperous. But in 1857, their land being wanted, they were removed to Wisconsin, and placed on a poor reservation there. They now number barely one hundred men, women, and children.

The *Delawares*, when first discovered by the whites, were living on the banks of the Delaware river. Early in the seventeenth century the Dutch commenced trading with them, under friendly relations. Subsequently William Penn bought large tracts of land from them, moving the Indians inland. A war followed this purchase, the Delawares alleging they had been defrauded, but with the assistance of the Six Nations, the whites forced them back west of the Alleghanies. In 1789 they were placed on a reservation in Ohio, and subsequently, in 1818, were moved to Missouri. Various removals followed, until, in 1866, they accepted lands in severalty, in Indian Territory, and gave up their tribal relation. They are now living in civilized fashion, and have become useful and prosperous citizens. Their number is now between 1,000 and 1,100.

Iroquois, or Six Nations.—This powerful and celebrated confederation was composed originally of five tribes known as Mohawks, Oneidas, Onondagas, Senecas, and Cayugas. Later, the Tuscaroras were admitted into the league, which was then called the "Six Nations." At that time their total number was estimated at 11,650, including 2,150 warriors. They were unquestionably the most powerful confederation of Indians on the continent. Their home was the central and western parts of New York State. In the war of the American Revolution they fought on the side of the English, and in the repeated battles their power was nearly destroyed. They are now scattered about on various reservations in New York State, Indian Territory, Wisconsin, and Canada. In 1870 they numbered altogether 13,669, having increased decidedly since the close of the Revolution.

The *Wyandots* or *Hurons* were an Iroquois tribe which lived originally on the shore of Lake Huron. They served as a shuttlecock between the Six Nations and the Sioux, being driven alternately east and west by them, until the end of the last century. In 1832 they removed to a reservation in Kansas. In 1855 many became citizens, while the small remaining fragment of this once powerful tribe removed to Indian Territory.

Chippewas or *Ojibways*.—This tribe, of the Algonquin family, formerly ranged over most of Michigan, Wisconsin and Minnesota. They were constantly at war with the Dakotas and with their other neighbors. They sided with the English in the Revolution and in the war of 1812. At present the tribe is divided upon thirteen reservations in the above States, and is making gratifying progress in civilization. Their number is now above 20,000.

The *Menominees*, on the Menominee river, in Wisconsin, have never been moved from their original habitat. They served with the French in the war against the Foxes in 1712, and against the English up to 1763. During the Revolution and the war of 1812 they sided with the English. They are now living in a

civilized manner, and are engaged very largely in lumbering. Their number is now about 1,445, and is said to be diminishing rapidly.

The *Miamis* were first found in eastern Wisconsin, and were estimated at 8,000 in number. They were a warlike race, continually engaged in broils with their neighbors, the Iroquois, Sioux and French, in which they lost heavily. In the Revolution and the war of 1812, like most of the Indian tribes, they sided with the English. After the latter war they fought among themselves, reducing their numbers greatly. The tribe has now almost entirely disappeared, a few families only remaining, scattered over Indian Territory and Kansas.

The *Ottawas* lived originally on the northern shore of the upper peninsula of Michigan. In 1650 they were driven by the Iroquois beyond the Mississippi, only to be forced back by the Dakotas. Then they settled at Mackinaw, and joined the French in their operations against the English. During the Revolution they sided with the English. Most of them were finally moved to the Indian Territory, where they now are, reduced to a mere handful.

The *Pottawattamies* occupied a part of the lower peninsula of Michigan, whence they were driven into Wisconsin by the more powerful Iroquois. They were allied with the French in their wars against the Iroquois, and took part in Pontiac's conspiracy. In the wars between the colonists and the mother country they took the part of the latter. In 1838 most of them were removed to a reservation in Kansas. Of these the larger proportion have abandoned the tribal relation, and become citizens. Of the others, some are in Kansas, upward of 300 are in Indian Territory, while the remainder are wanderers.

The *Seminoles* are a tribe of the Muskogee family; they originally inhabited the peninsula of Florida. About 1842, after a very disastrous war with the whites, lasting seven years, nearly all of them were removed to Indian Territory, where they are now settled, are civilized, and are succeeding in the cultivation of the soil. Their number about 2,500.

The *Creeks* or *Muskogees* formed the most powerful tribe of the Muskogee family; they originally occupied a large part of Georgia, Alabama and Florida. During the Revolution they fought against the colonists. A few years later they broke out again, but received a severe chastisement. Subsequently nearly all of them were removed to Indian Territory, where they have made great progress in civilization and material prosperity. During the late civil war they were divided, part adhering to the Union and part joining the Confederacy. At present they number about 14,000.

The *Dakota* or *Sioux* nation is at present the most powerful of the Indian tribes in North America. Its warriors possess fine physique, great personal courage, and great skill in warfare. Though backward in adopting civilization, their intellectual powers contrast very favorably with those of most other tribes. The nation numbers 30,000 to 35,000 souls, divided into twenty-one bands of sub-tribes more or less independent of one another. At present they range over most of the unsettled portion of Dakota, eastern Montana and northeastern Wyoming, their reservations amounting altogether to 108,450 square miles. A portion of their reservations in the Dakotas has been recently transferred by them to the General Government, and will, it is thought, shortly be thrown open for settlement by whites. Until within a very recent period most of the bands of this tribe have resisted all efforts for civilizing them. At present, however, several of the bands are settling down to agricultural labor. Their history has, from the first, been one

of war, their name a terror to their Indian neighbors as well as to the whites. Originally their range extended as far east as the State of Wisconsin, and thence west to the Rocky Mountains, its present limit. On the east they encountered the Chippewas, who at that time formed a powerful tribe, fully able to cope with them. By them the Sioux were driven back into Minnesota, after long continued warfare. In 1862 the bands inhabiting Minnesota fell upon the white settlers, and a terrible massacre ensued. The result of this was the removal of these bands from the State to Dakota, where they were placed upon reservations. The bands inhabiting the country further west have been to a greater or less extent almost continually at war with the whites until 1877; and for many years the protection of the border settlements required the constant presence of large bodies of troops. In 1875 and 1876 the chief, Sitting Bull, at the head of a large body of warriors, maintained a successful resistance against all the troops which could be brought against him, and finally escaped across the boundary line into the British Possessions, with the bulk of his followers. It was during this campaign that General Custer and his entire command were slain.

The *Arapahoes* originally ranged over the central portion of the plains between the Platte and Arkansas. This is a brave, warlike, predatory tribe. With the Sioux and Cheyennes, with whom they have ever been on terms of friendship, they have waged unremitting warfare upon the Utes. From time to time, also, the border settlements have received hostile attentions from them. The southern bands of the tribe have a large reservation in the western part of Indian Territory, while the northern bands have been placed on the reservation of the Shoshones in western Wyoming.

The *Cheyennes* are a tribe of the Algonquin family, which originally lived on the Cheyenne river, a branch of the Red River of the North, in Dakota. Driven westward by the Dakotas, they were found by early explorers at the eastern base of the Black Hills, in Dakota. Subsequently part of them moved south, and allied themselves with the Arapahoes. Within a few years they have all been collected on a reservation in the western portion of Indian Territory. Their whole history has been a series of wars against their red neighbors and the whites. They are a large, powerful, athletic race, mentally superior to most of the other tribes. Their occupations are war and hunting. Thus far they have made little or no progress in civilization. Their number about 3,600.

The *Arikarees*, *Gros Ventres*, and *Mandans* are three tribes which inhabit a permanent village at Fort Berthold, Dakota, on the Missouri. They have a partial civilization of their own, not acquired from intercourse with whites. They live in houses made of wood, covered and thatched with earth and straw. For sustenance they depend largely upon the produce of agricultural labor. Their total number is probably about 2,000, the Arikarees being the largest tribe, and the Mandans the smallest.

The *Sacs* and *Foxes*, now one tribe, located in Indian Territory, were originally separate, living near Green Bay, Wis.

The *Shawnees* or *Shawanoes*, supposed to have been primarily a part of the Kickapoo tribe, were first found in Wisconsin. Moving eastward, they came in contact with the Iroquois, by whom they were driven south into Tennessee. Thence they crossed the mountains into South Carolina, and spread northward as far as New York and southward to Florida. Subsequently they drifted northward, again came in contact with the Iroquois, and were driven over into Ohio. They joined in

Pontiac's conspiracy, and during the Revolution fought under the English flag. After the latter war they commenced migrating westward, and finally accepted homes in Indian Territory, where they now are. In 1854 most of them abandoned tribal relations, and divided their lands in severalty. They are now in a civilized and prosperous condition.

The *Crows* or *Upsarokas* are a branch of the Dakota family occupying at present a large reservation in southern Montana, south and east of the Yellowstone river. Their original range included this reservation, and extended eastward and southward, while from their forays no part of the country for many hundreds of miles around was safe. A cowardly tribe, they have ever been noted as marauders and horse stealers. Though they have generally been crafty enough to avoid open war with the whites, they have not scrupled to rob them whenever opportunity offered. Physically they are tall and athletic, with very dark complexions. Their number is about 4,200. They have made little if any progress in civilization, preferring to be supported by the government.

The *Osages* were first found on the lower Missouri, whence they moved south to the Arkansas, and shortly after became allies of the French. After the usual succession of treaties and removals, they finally found themselves in Indian Territory, where they are now fast reaching a condition of self-support. They number about 2,100 souls.

The *Kaw* or *Kansas* tribe was originally an offshoot from the Osages. Their original home was in Missouri, whence they were driven to Kansas by the Dakotas. They were moved from one reservation to another, until finally they were placed in Indian Territory, where they are rapidly becoming civilized. They numbered 360 souls in 1889.

The *Winnebagoes* are a branch of the Dakota family. At the time of the advent of the whites they formed the vanguard of the eastward migration of the Dakotas, and were living about Winnebago Lake and Green Bay in Wisconsin. They took up arms on the side of the French in the Franco-English wars, on the side of the English in the Revolution and the war of 1812. In 1820 they numbered about 4,500, and inhabited their original home. A series of treaties followed, by which they were moved no less than six times, occupying reservations in various parts of Minnesota and Dakota. At present they are on the Omaha reservation in eastern Nebraska, and are prospering.

The *Otoes* and *Missouris*, which now form one tribe, under the former name, are a branch of the great Dakota family. They were early allies of the French. They now inhabit a small reservation in Nebraska, where they are making gratifying progress. They number but 457.

The *Omahas* were found on St. Peter's river, in Minnesota, where they lived an agricultural life, supporting themselves from the soil. After a fatal visitation of the smallpox, which reduced their numbers terribly, they abandoned their village, and wandered westward to the Niobrara river in Nebraska. After a succession of treaties and removals, they are now located on a reservation in eastern Nebraska, where they are rapidly improving in civilization and pecuniary resources. They numbered 1,100 in 1878.

The *Poncas* were originally part of the Omaha tribe, with whom they lived near the Red River of the North. They shared the common fate of the weaker tribes in this part of the country, being driven westward by the Dakotas. They halted on the Ponca river in Dakota, and there held their ground, but suffered severely from their hereditary enemies. After a succession of treaties

and removals, they were placed on a reservation at the mouth of the Niobrara, where they took lands in severalty, and were prospering greatly, when they were forced to give up their lands and improvements and remove to Indian Territory. Naturally they were extremely dissatisfied with this change, and, in 1878, a number of them left the reservation in Indian Territory and made their way back to the Omahas, their former neighbors. They were arrested for leaving the reservation, and were about to be returned to Indian Territory, when the case was taken up by able lawyers, and, after a long trial, the Indians were set free, it having been decided that they were United States citizens, and therefore not to be confined on reservations. The whole history of the Poncas is a tale of oppression by red men and white.

The *Pawnees* were formerly a brave, warlike tribe, living on the Platte river in Nebraska. Their history, until a recent date, is one of almost constant warfare with the Dakotas. In 1823 their village was burned by the Delawares, and, shortly after, the tribe lost heavily by the smallpox. In 1874 they moved to a reservation in Indian Territory, where they are making gratifying progress. They number 1,440.

The *Caddos*, now located on a small reservation in Indian Territory, are but the remnant of a large tribe that formerly ranged over the Red River country, in Arkansas, northern Texas and Indian Territory. They have well-managed farms, and are noted for industry and intelligence. Their number is 543.

The *Shoshones* or *Snakes* are a tribe inhabiting the country about the head of the Snake, Green and Big Horn rivers, in Wyoming, Idaho and northern Nevada, and distributed mainly on four reservations. They number about 6,000. They are a mild, peaceful tribe, but, until within a recent period, have been involved in almost constant defensive warfare with their neighbors, the Crows and Blackfeet on the north, and the Cheyennes and Arapahoes on the south. The history of their relations with the whites has been one of almost unbroken peace.

The *Bannacks* are a small tribe of the Shoshone family, in the southern portion of Idaho.

The *Kiowas* are another tribe of the Shoshone family, a wild, roving people, ranging over the country about the Arkansas and Canadian rivers, in Indian Territory, Colorado, and New Mexico. In 1869 they were placed on a reservation in Indian Territory, which they appear to use only as headquarters for raids into the adjoining country. Their number is given as 1,138, but this is undoubtedly too small.

The *Ute* or *Utah* tribe, which is composed of several bands, all acknowledging the authority of one head chief, inhabits reservations in the western part of Colorado and eastern Utah. They number about 4,200. Averse to civilization, they have made little or no progress. The rapid settlement of the State has driven them westward, and has deprived them of the fairest portion of their domain.

The *Apaches* are a branch of the Athabasca family, which has wandered far from the parent region, and now ranges over large parts of New Mexico and Arizona. It is a powerful, warlike tribe, at war with the whites almost continually since the latter entered the country. A large part of the tribe is on the Fort Stanton reservation in eastern New Mexico, while another portion, under the chief Victoria, has for a long time been devastating the border settlements of New Mexico. The Tonto-Apaches, collected in large numbers on the San Carlos reservation in Arizona, where they are doing something at farming, are of Yuma stock. Besides these, there are several bands of Apaches scattered

about on other reservations, or roaming without a fixed habitat, swelling the total to about 10,600 souls.

The *Navajoes* are another tribe of the Athabascan group which is far removed from the body of the family. They inhabit the northern part of Arizona and New Mexico, where they have a fine reservation. They have considerable native civilization, not a few of them engaging in agriculture, and in raising horses, sheep, and goats. They weave blankets, which are prized highly throughout the southwest. They are a fine, athletic race, and excellent horsemen. While not an aggressive tribe, they have frequently been at war with the whites. They number now 11,850.

The *Nez Percés*, with the exception of a small portion in Indian Territory, inhabit a reservation in northern Idaho, which includes a part of their ancestral home. They are a fine race, physically and mentally. Until 1877 they had been at peace with the whites. In 1875, a portion of their reservation having been taken from them, owing to the alleged fact that they had not carried out the treaty stipulations, difficulties arose which, two years later, brought on a rupture, and the famous "Nez Percés" war. The disaffected portion of the tribe, numbering some 400 or 500, held out for several months against all the force the government could bring against them, but were finally captured on the Sweet Grass Hills, in northern Montana. The malecontents were then placed on a reservation in the Indian Territory.

The *Modocs* are a small tribe, which lived in southern Oregon. They are known mainly from their stubborn resistance to the United States Government in 1872 and 1873, known as the Modoc war. This was caused by an attempt to place them upon a reservation. After some preliminary fighting, the Modocs retreated to the "Lava Beds," a basaltic region, seamed and creviced, and abounding in caves. Here they made a stand for several months before they were finally subdued. During the war General Canby, commanding the troops, and Doctor Thomas, a peace commissioner, were treacherously massacred by them while under a flag of truce. The leaders of this revolt were hanged, and the remainder removed to Indian Territory.

The *Pimas*, *Papagoes* and *Maricopas* form a semi-civilized community, living on a reservation on the Gila and Santa Cruz rivers in Arizona. Originally they were distributed over the whole southwestern portion of that territory. Missions were established among them at an early date by the Spanish Jesuits, and with very good success. At present they are mainly self-supporting, while a large proportion of them wear citizens' dress and live in houses. The three tribes now number 10,500.

Pacific Coast Indians.—The Indians upon and near the Pacific coast are divided into a great number of small tribes. Speaking generally, they are lower in the scale of humanity, both physically and mentally, than those of the interior. In northern California, Oregon, and Washington their principal subsistence was, before the government undertook their support, the salmon, which in spring crowded the rivers. They are mostly of a mild, peaceful disposition. The Indians of southern California were early taken in charge by the Jesuit missionaries, who Christianized and partly civilized them. Since the settlement of the State by Americans, they have, through neglect, to a large extent relapsed and become worthless members of society.

The name *Pueblo* (city) is used to designate a number of tribes of town-building Indians in New Mexico. They resemble one another very closely in their surroundings, and in their manners and customs; and their history has been the same. Subdued by Coronado in 1540, they made a successful revolt two years later, but were subdued again in 1586. In 1680 they made

another successful revolt. When the country was ceded to the United States in 1848, these Indians were recognized as citizens, and have since remained so. Their houses are communal, generally but one structure for the whole village. They are sometimes built of stone, but oftener of adobe, several stories high, each story receding from the one below. The common plan is a hollow square, or curved figure, though in some cases the form of a pyramid is followed. Some of the towns are built upon high mesas, almost inaccessible, obviously for purposes of defense. These Indians retain their primitive form of government, each village electing a governor and council. They cultivate the soil, raising grain and vegetables for their own consumption, and keep large flocks of sheep and goats. Their number is about 9,000.

The *Moquis* are a semi-civilized people living in seven towns on the plateau in northern Arizona. Our first accounts of them date from the expedition of Coronado in 1540. Their history is similar to that of the town-building Indians of New Mexico, except that since a successful revolt against the Spaniards, in 1680, they have remained independent. They are kind-hearted and hospitable, cultivate the soil, raising grain and vegetables, and possessing large flocks of sheep and goats. They weave very fine blankets, an art which they have taught several neighboring tribes. The houses are built of stone, set in mortar, and for security are perched upon the summits of almost inaccessible mesas. The Moquis numbered 1,780 in 1878.

INDIAN ANTIQUITIES.—The ancient remains of the Indians are coëxtensive with their occupancy of the country, but in general they teach but little concerning their life in prehistoric times. The Atlantic and Gulf coasts are lined with shell-heaps, indicating the sites of ancient villages. Spear or arrow heads are often plowed up all over the country, relics, it may be, from some well-fought field.

At the copper mines on the northern peninsula of Michigan, there are many evidences that the Indians had been working. Excavations, some of considerable depth, have been found, and in them stone hammers, evidently used in extracting the native copper. Indeed, it is well known that this metal was a common article of commerce among them.

In the southwestern territories, however, are found the most interesting remains of this people, in the form of towns, some of great magnitude and extent, built of stone set in mortar. These towns, which were evidently inhabited by a people closely resembling the Moquis and Pueblos, are found in southwestern Colorado on the San Juan river and its branches, in northwestern New Mexico, in southeastern Utah, and over the greater part of Arizona. Certain regions appear to have been very densely populated. The largest towns are built in exposed situations, without special precautions for defense, and were plainly inhabited by a mild, agricultural race, who were enjoying a period of peace. Others are perched upon high, inaccessible mesas, with strong towers for defense and observation, while others, "cave dwellings," are merely walled-in niches in the cliffs of the cañons—evidently the last refuge of a hunted, desperate people. Everywhere in the neighborhood of these ruins are vast quantities of fragments of pottery, some of which is painted in the most elaborate designs. Wicker work and arrow and spear heads are also found in abundance. These extensive ruins, scattered over a large area of country, show that at some time in the past this region, now arid and desert, supported a large population of a degree of civilization fully equal to that of the Pueblos and Moquis of the present day, and in all probability their ancestors.

INDIAN TERRITORY. This portion of our country lies in the southern central portion of the United States, and is bounded on the north by Kansas, on the east by Missouri and Arkansas, and on the south and west by Texas. The area of the country as recently existing was estimated at about 70,000 square miles, but has since April 22, 1889 (on which date, by proclamation of President Benjamin Harrison in pursuance of an act of Congress, the Oklahoma Territory was opened for settlement), been diminished by about 1,877,800 acres. The Territory was a part of the French possessions which the United States acquired by the purchase of Louisiana under Jefferson's administration in 1803, and, together with a tract of land ceded by Texas in 1845, comprised a much greater area than is within its present boundaries. In 1859 Kansas was formed from a portion of its territory, and its limits shrunk to about 70,000 square miles as above stated. The first Indians removed hither by the Government were the Creeks, Cherokees, Chickasaws and Choctaws, who were placed on the reservations allotted to them in the period between 1833 and 1846. Since that time various tribes and remnants of tribes have been removed from their old habitats to this country, and although there has been at times resistance offered by the Indians to these translations, it may be said that the work has been effectually done. These various "nations" have their own governments—the Cherokees having a representative democracy, while the control of the other tribes is vested in a patriarchal or tribal form of government. There is, however, of late years a general council in which the different tribes participate through their representatives. Each tribe has its own reservation, and none of the lands are held in severalty. The United States is represented at the different agencies, the affairs of each agency being managed by an appointee of the government. The total number of the population in the territory is estimated at about (1890) 119,000. This must be understood, however, as not including Oklahoma, from which no reliable figures can as yet be obtained.

The condition of the Indian inhabitants is very varied, some of the tribes or nations being well advanced in civilization while others are almost aboriginal in their manners and customs. The Cherokees have a peculiar syllabic alphabet of eighty-five characters, and the Choctaws also have a written language. Common schools are maintained either by the Indians themselves or by the General government, while higher education and industrial training have also institutions for their furtherance. There are newspapers and books published in the language of the tribes having a written literature, and the missionaries (mainly Protestants) are strenuous in their endeavors to increase the number of native publications. The most promising children among the Indians are from time to time selected and sent to the various Indian schools in different parts of the country, and in not a few instances young men of the more civilized nations enter our schools of collegiate and university grade, where their standing and scholarship are inferior to none. The Cherokees, Chickasaws, Creeks, Choctaws, and Seminoles are the most advanced among the tribes and constitute the five principal "nations."

Of late years various tribes have been taken from the northwestern portions of the country and placed on reservations here, and in one instance the transfer was so unsatisfactory that the Indians (the Nez Percés), had to be removed and sent back to the vicinity of their old haunts. The Modocs were placed here in 1874, and seem to be outstripping their older-settled neighbors in the arts of civilization and peace.

The treaty of 1866 constituting the general council also erected tribunals for the trial of causes of a civil nature between the people of various tribes and persons other than Indians, but the criminal cases in which white men are concerned are tried by the United States courts of the neighboring states, mostly in the western district of Arkansas. Where the offenders and plaintiffs are both Indians they are tried by the tribal or council courts.

Many of the Indians among the older-settled tribes were slaveholders before the war of secession, and some of them took up arms in support of the Confederacy, thereby greatly damaging their interests. The treaty of 1866, however, settled the questions opened by such action, and the recent throwing open of Oklahoma was one of the results of their taking arms against the United States government. (See OKLAHOMA.)

The natural features of the territory are varied. In the eastern portions the soil is fertile and well watered. The conformation of the surface is that of a rolling prairie, while in the western portion the land lies in one vast treeless slope ("the Great Plains"), dry and needing irrigation to successfully cultivate crops. Between these two regions there runs from north to south a belt of timber from sixty to seventy miles wide.

The mean annual temperature is to some degree lower than in the same latitude east of this point, while the variations of kindred seasons is yet more marked. In the south and southeastern parts of the territory there are low ranges of hills rising to an altitude of 1,500 feet. These form a part of the Ozark range, which extends into Missouri and Arkansas.

The principal rivers of the territory are the Arkansas with its branches, the Neosho, the Salt and Red Forks, and the Canadian, with its North Fork, and, in the southern part of the territory, the Red River, which forms the boundary with Texas, and its branch, the Ouachita. All these are of little or no importance as regards navigation. The eastern part of the territory is well watered, but the western part, except at times of flood, in late spring and early summer, has few flowing streams.

It is highly probable that the Territory contains extensive deposits of coal, and it is very possible that the precious metals may be found in the Ozark Hills, but at present little is definitely known of the geology of the country.

The fauna and flora partake of the double character of the surface and climate. In the eastern part they tend toward subtropical types, while the western portion presents forms more or less peculiar to the arid plains. In the eastern part deer, and brown and black bears are quite abundant, except in the neighborhood of settlements; and wild turkeys are plentiful. In the western part antelopes and deer are the principal large game; wild horses are still occasionally met with; and various species of grouse, sage-hens, owls, rattlesnakes, gophers, and prairie dogs are abundant. The vegetation of the eastern part is profuse, especially in the bottom lands. The forests present a great variety of species very similar to those found throughout the lower Mississippi valley; among them are several species of oak and pine, cypress, red cedar, black walnut, gum-tree, etc. Among the wild fruits, which also present much variety, are plums, persimmons, grapes, etc. On the plains of the western part of the territory the principal natural productions are the grasses which, growing in tufts or bunches, are known collectively as bunch or buffalo grass. While this is the prevailing growth, in the more desert localities its place is usurped more or less by artemisia, cactus, and yucca.

The population of the Territory is almost entirely



rural. There are no large towns. The principal settlements are Tahlequah, the capital of the Cherokee nation; Caddo in the Choctaw, Muscogee in the Creek, and Tishomingo in the Chickasaw country; and Vinita, a railroad town on the Missouri, Kansas, and Texas line.

INDIA-RUBBER, or CAOUTCHOUC, consists of the dried coagulated milky juice of various trees and shrubs, belonging chiefly to the natural orders *Euphorbiaceæ*, *Moraceæ*, *Artocarpaceæ*, and *Apocynaceæ*. Although a milky juice is found in plants of many other families, it does not in all cases yield caoutchouc, nor do different species of the same genus yield an equal quantity or quality of that substance. On the other hand, there are many plants which afford a good rubber, but have not yet been sought out for commercial purposes. The milky juice of plants furnishing caoutchouc is contained chiefly in the middle layer of the bark, in a network of minute tubes known to botanists as laticiferous vessels. In the *Apocynaceæ* these vessels are found also in the inner bark, or bast layer. The milky juice above mentioned possesses the properties of a vegetable emulsion, the caoutchouc being suspended in it in the form of minute transparent globules. Like other emulsions, it is easily coagulated by the addition of an acid or saline solution—alum or salt water being commonly used for this purpose, but it is said by Mr. Bruce Warren not to be coagulated by alcohol. The caoutchouc appears to be kept in suspension in the juice by means of ammonia; at least in some cases the fresh milk exhales an ammoniacal odor. Probably it is on this account that the addition of liquid ammonia prevents the juice from coagulating for a considerable length of time; and the ammonia is in certain districts added when the milk has to be carried some distance from the place of collection. The addition of salt water to the juice is to be deprecated, as it renders the caoutchouc very hygroscopic. The best rubber known is obtained by careful evaporation of the recently strained juice at a moderate heat. Trees are known to contain caoutchouc by the bark on incision yielding a milk that when rubbed between the fingers coagulates into an elastic fiber. The dried bark of such plants when broken shows between the two fractured surfaces of bark a number of silky fibers which can be stretched for some distance without breaking.

Caoutchouc differs from other vegetable products of like origin by possessing considerable elasticity, by being insoluble in water or alcohol, alkalies and acids (with the exception of concentrated nitric and sulphuric acids). Although apparently simple in constitution, it contains not only the elastic substance to which its commercial value is due, but a small quantity of an oxidized viscid resinous body soluble in alcohol. This latter substance varies in quantity in different kinds of rubber, those containing the smallest amount, such as the Pará and Ceara, being considered the most valuable, while those in which it is present in greatest proportion, such as the Guatemala and African rubbers, are the least esteemed. Rapid evaporation of the juice, or any means which prevents oxidation, tends to prevent the formation of this viscid resin.

The first notice of india-rubber on record was given nearly five hundred years ago by Herrera, who, in the second voyage of Columbus, observed that the inhabitants of Hayti played a game with balls made "of the gum of a tree," and that the balls, although large, were lighter and bounced better than the wind-balls of Castile. Torquemada, however, seems to have been the first to mention by name the tree yielding it.

In 1751 the researches of M. Fresnau, an engineer residing in Guiana, were published by the French Academy, and in 1755 M. Aublet described the species yielding caoutchouc in French Guiana. Nevertheless

india-rubber remained for some time unknown in England except as a curiosity, for Doctor Priestley, in the preface to his work on perspective, called public attention to it as a novelty for erasing pencil marks, and states that it was sold in cubical pieces of one-half inch for 3s. each. India-rubber was not known as a product of Asia until 1798, when a plant, afterward named *Urceola elastica*, Roxb., was discovered to yield it by Mr. J. Howison, a surgeon of Prince of Wales Island, and soon afterward Assam rubber was traced by Doctor Roxburgh to *Ficus elastica*, Roxb. It was not, however, until the beginning of the eighteenth century that the india-rubber industry really commenced.

Notwithstanding the fact that caoutchouc-yielding trees are found in a large belt of countries around the globe, including at least 500 miles on each side of the equator, yet the demand for the best qualities of india-rubber is in excess of the supply. The varieties which are almost exclusively used when great elasticity and durability are required are the Pará, Ceara, and Madagascar rubbers.

I. SOUTH AMERICAN.—*Pará rubber* is obtained chiefly from *Hevea brasiliensis*, Müll. Arg., a large euphorbiaceous tree upward of sixty feet in height, branching from the base, and having trifoliate leaves, the leaflets being lanceolate and tapering at both ends. Other species of *Hevea*, as well as *Micrandra siphonoides* and *M. minor*, Benth., all of which grow abundantly in the moist, steamy valleys of the Amazon and its tributaries, are also used indiscriminately by the natives to furnish Pará rubber. These trees are found in different districts, but all flourish best on rich alluvial clay slopes by the side of rivers, where there is a certain amount of drainage, and the temperature reaches from 89° to 94° at noon and is never cooler than 73° at night, while rain is rarely absent for ten days together. The genus *Hevea* was formerly called *Siphonia*, and the tree named Pao de Xerringa by the Portuguese, from the use by the Omaqua Indians of squirts or syringes made from a piece of pipe inserted in a hollow flask-shaped ball of rubber.

The caoutchouc is collected in the so-called dry season between August and February. The trees are tapped in the evening, and the juice is collected on the following morning. To obtain the juice a deep horizontal incision is made near the base of the tree, and then from it a vertical one, extending up the trunk, with others at short distances in an oblique direction. Small shallow cups made from the clayey soil and dried in the sun are placed below the incisions to receive the milk, each cup being attached by sticking a piece of soft clay to the tree and pressing the cup against it. The juice, of which each tree yields only about six ounces in three days, has a strong ammoniacal odor, which rapidly goes off, and in consequence of the loss of ammonia it will not keep longer than a day unchanged, hence when it has to be carried to a distance from the place of collection 3 per cent. of liquid ammonia is added. The juice is said by Bruce Warren to yield half its weight of caoutchouc, but 32 per cent. appears to be the usual quantity. To obtain the rubber the juice is heated in the following manner:—A piece of wood about three feet long, with a flattened clay mold at one end of it, is dipped in the milk, or this is poured over it as evenly as possible. The milk is then carefully dried by turning the mold round and round in a white vapor obtained by heating certain oily palm nuts, those of *Attalea excelsa* being much preferred, and the vapor being confined within certain limits by the narrowness of the neck of the pot in which the nuts are heated. Each layer of rubber is allowed to become firm before adding another; a practiced hand can make five or six pounds in an

hour. From whatever cause, the rubber thus prepared is the finest that can be obtained. The cakes when completed are, in order to remove them from the mold, slit open with a sharp knife, which is kept wet, and are hung up to dry. The flat rounded cakes of rubber made in this manner are known in the London market as "biscuits." They rarely contain more than 15 per cent. of moisture. The scrapings from the tree, which contain fragments of wood, are mixed with the residues of the collecting pots and the refuse of the vessels employed, and are made up into large rounded balls, which form the inferior commercial quality called "negrohead," and often contain 25 to 35 per cent. of impurity. An intermediate quality is known as "entre-fine." Pará rubber is said to be sometimes adulterated with the juice of the *Maçandaruba* tree (*Minusops elata*), which might account for the great differences that have been occasionally observed in the behavior of Pará rubber in certain stages of manufacture, the coagulated juice of the *Mimusops* genus resembling gutta-percha rather than caoutchouc.

Ceara rubber is considered almost next to the Pará in value, as it is a "dry" rubber, very elastic and free from stickiness; but it often contains a quantity of wood and foreign matter arising from the mode of collecting it, the loss in washing previous to manufacture amounting sometimes to twenty-five per cent. It is the produce of *Manihot Glaziovii*, Müll. Arg., a euphorbiaceous tree common in the province of Rio Janeiro, about thirty feet high, with a rounded head of foliage, and grayish green three to seven lobed palmate leaves, somewhat resembling the leaves of the castor-oil plant in shape and size. The trees are tapped, according to Mr. R. Cross, when the trunk attains a diameter of four to five inches, *i.e.*, when they are about two years old. The mode of collecting the rubber is as follows:—After brushing away the loose stones and dirt from the root of the tree by means of a handful of twigs, the collector lays down large leaves for the milk to drop upon. He then slices off the outer layer of the bark to the height of four or five feet. The milk, which exudes in many tortuous courses, some of it ultimately falling on the ground, is allowed to remain on the tree for several days, until it becomes dry and solid, when it is pulled off in strings, which are either rolled up into balls or put into bags in loose masses, in which form it enters commerce under the name of Ceara "scrap." The amount of Ceara rubber imported in 1879 amounted to 500 hundredweight. The attempts which have been recently made to cultivate this rubber plant in India have been attended with signal success. In Rio Janeiro it grows in a rocky or stony arid region, where a short under-scrub is the only vegetation, and the atmosphere is hot and dry, the temperature ranging from 82° to 90° Fahr. It is, therefore, suited for cultivation where the *Hevea* will not grow. In Ceylon it has been found to thrive at an altitude of from 200 to 3,000 feet above the sea-level. At Zanzibar and Calcutta also it succeeds well. The seeds, which have a hard, thick coat, take a year in germinating, unless the edges near the end bearing the caruncular projection are rasped off. Cuttings, provided they have a single bud, strike readily.

Pernambuco or *Mangabeira rubber* is obtained from *Hancornia speciosa*, Gom., an apocynaceous tree common on the South American plateau in Brazil from Pernambuco to Rio Janeiro, at a height of 3,000 to 5,000 feet above the sea. It is about the size of an ordinary apple-tree, with small leaves like the willow, and a drooping habit like a weeping birch, and has an edible fruit called "mangaba," for which, rather than for the rubber, the tree is cultivated in some districts. Only a small quantity of this rubber is exported, and it is not much

valued, being a "wet" rubber. It occurs in "biscuits" or "sheets." The caoutchouc is collected in the following manner:—About eight oblique cuts are made all round the trunk, but only through the bark, and a tin cup is fastened at the bottom of each incision by means of a piece of soft clay. The cups when full are poured into a larger vessel, and solution of alum is added to coagulate the juice. In two or three minutes coagulation takes place, and the rubber is then exposed to the air on sticks, and allowed to drain for eight days. About thirty days afterward it is sent to market. Pernambuco rubber, as is the case with most rubbers coagulated by saline solutions, contains a large quantity of water.

Cartagena rubber comes from New Granada in the form of black sheets three-fourths of an inch thick, having a somewhat rough or "chewed" appearance, and is more or less "tarry" or sticky. It also occurs in the form of strips or small pieces pressed together in bags. Its botanical source is not known, but is thought to be a pinnate-leaved tree, a portion at least being derived, it is supposed, from *Castilloa elastica*. It loses 35 per cent. of moisture when dried.

Guayaquil rubber is imported from Ecuador in large flakes or lumps, of a whitish color in the best kinds, the inferior sorts being porous and filled with a foetid black liquid, having an odor of cow-dung, and staining the knife and hands. It is believed to be obtained from *Castilloa elastica*. In washing for manufacture it sometimes loses up to 40 per cent. of its weight. The bulk of the two last-mentioned rubbers is exported to the United States.

II. CENTRAL AMERICAN.—The source of all the principal rubbers exported from Central America is *Castilloa elastica*, Cerv., a lofty artocarpaceous tree, with a trunk three feet or more in diameter, and large, hairy, oblong lanceolate leaves often eighteen inches long and seven inches wide, those subtending the young branches being much smaller and more ovate. The tree grows most abundantly in a sporadic manner in the dense moist forests of the basin of the Rio San Juan, where the rain falls for nine months in the year. It prefers rich, fertile soil on the banks of watercourses, but does not flourish in swamps. It is found also in Costa Rica, Guatemala, Honduras, Mexico, Cuba, and Hayti, and in Panama in company with another species, *C. Markhamiana*, Collins, and on the west coast of South America down to the slopes of Chimborazo, the Cordilleras of the Andes separating the *Castilloe* from the *Hevea* of Brazil, according to Mr. R. Spruce.

Nicaragua rubber.—In Nicaragua the juice is collected in April, when the old leaves begin to fall and the new ones are appearing, during which time the milk is richest. The tree is tapped either in the same manner as the *Hevea*, or by encircling the tree with a simple spiral cut at an inclination of 45°, or by two spirals in opposite directions if the tree be large. At the bottom of the spiral an iron spout about four inches long is driven into the tree, and the milk is received in iron pails. A tree twenty to thirty feet high to its first branches, and about four feet in diameter, is expected to yield twenty gallons of milk, each gallon giving about two pounds of rubber. In the evening the milk is strained through a wire sieve and transferred to barrels. The milk is coagulated by the addition of the juice of the "acheté" plant (*Ipomœa bona-nox*, L.) or of another plant called "coasso." The strained juice of either of these plants, obtained by bruising the moistened herb and subsequent expression, is added to the milk in the proportion of about one pint to the gallon. If these plants are not procurable, two parts of water are added to one of the milk, and the mixture allowed to

stand for twelve hours. The coagulum is next flattened out by a wooden or iron roller to get rid of the cavities containing watery liquid, and the sheets are then hung up for fourteen days to dry, when they weigh about two pounds, the sheets being usually one-half to one-eighth inch thick and twenty inches in diameter. When coagulated by water, the mass is placed in vats in the ground and allowed to dry, this taking place in about a fortnight. It is then rolled into balls. That which dries on the incisions in the tree is called bola or burucha, and is said to be highly prized in New York. The loss of Nicaragua rubber in drying is estimated at 15 per cent. It is exported chiefly from San Juan del Norte, or Grey Town, and the larger proportion goes to the United States. The *Castilloa* appears to be suitable for cultivation only in districts where the Pará rubber would grow equally well. The deciduous lateral shoots if blanted will never grow erect.

West Indian rubber is the variety usually imported into England, but in comparatively small quantity only. It occurs in the form of blocks, the finest quality consisting of thin separable sheets, and the second of "scraps," usually conglomerated and containing fragments of bark. It is the best description of Central American rubber known. It is not, as its name seems to imply, produced in the West Indies, but derives its appellation from being brought over in West Indian steamers.

Honduras rubber is of good quality, and free from "tarry" matter.

Guatemala rubber is a very inferior kind and very unequal in quality; the best varieties are whitish, and the "lower" are black with a "tarry" appearance. It occurs in the form of sheets compacted together, from between which when pressed a thick, resinous fluid exudes. This when evaporated leaves a hard, resinous substance unaffected by hot water or steam. The rubber is collected from the trees as in Nicaragua, but it is poured on mats to dry, and the thin sheets are subsequently peeled off, folded into squares, and subjected to pressure to remove as much as possible of the contained moisture.

Siphocampylus Caoutchouc, Don., and *S. Jamesouianus*, D. C., Central American plants belonging to the natural order *Lobeliaceæ*, are also stated to yield rubber of good quality; and at the Philadelphia exhibition a rubber called Durango caoutchouc, obtained from a composite plant, was exhibited.

III. AFRICAN.—India-rubber is produced throughout equatorial Africa, the chief districts of export being the Gaboon, Congo, and Benguela on the west coast, and Madagascar, Mozambique, and Mauritius on the east. Africa, in respect of the large amount exported, may now be considered as taking the second place as an india-rubber producing continent.

Mozambique rubber, which is one of the most important varieties, occurs in the form of balls about the size of an orange, and "sausages," or spindle-shaped pieces, made up of slender strings of rubber wound around a piece of wood, which is eventually removed; or sometimes it occurs in smooth pieces of irregular size known as "cake" or "liver." *Madagascar rubber* consists of two qualities, the best of a pink and the inferior or "lower" of a black color, and occurs in shapeless pieces.

The other kinds included under the general name of African are amorphous lumps called "knuckles" from Congo; small "negroheads" or "balls" of scrap, and smooth cakes from Sierra Leone; small square pieces like dice called "thimbles," and others more irregular in shape called "nuts," and "small negroheads" from the Portuguese colonies; "tongues," consisting of flat pieces, usually wet and sticky, from the Gaboon; and

"balls" from Liberia. African rubber as a rule possesses more adhesiveness and less elasticity than Pará rubber, and is inferior in value. Comparatively little is known of the plants yielding caoutchouc in Africa or of the mode of collection.

IV. ASIATIC.—The rubbers which enter commerce from Asia include the Assam, Borneo, Rangoon, Singapore, Penang, and Java kinds.

Assam rubber, although fairly elastic, is much depreciated in value by the careless mode of collection, and often loses, by washing at the manufactory, as much as 35 per cent. of dirt, consisting of clay, sand, or bark.

Palay rubber is the product of *Cryptostegia grandiflora*, R. Br., an asclepiadaceous plant common on the coast of India; and from *Willughbeia edulis*, Roxb., and *W. martabanica*, D. C., a rubber is obtained in Chittagong.

Borneo rubber comes to market in the form of balls or shapeless masses, internally of a white or pinkish color, and very porous and spongy, the pores being usually filled with salt water, in consequence of which it often loses 20 to 50 per cent. of its weight in drying.

In Sumatra caoutchouc is obtained from *Willughbeia firma*, and is exported to Holland. Malacca rubber is said to be obtained from *Urceola elastica*, Roxb.

Rangoon rubber and those of Penang and Java are imported into England in small quantities only, and are irregular in appearance. From its physical characteristics, a portion at least of Rangoon rubber is believed to be the produce of a species of *Ficus*, probably *F. hispida*, L. Another caoutchouc-yielding plant, *Urceola* (*Chavannesia*) *esculenta*, Benth., belonging to the *Apocynaceæ*, has, however, been recently discovered in Burmah, some specimens of which at the age of five years have stems six inches in diameter, while the crown covers an area of 200 square feet. It has been recommended for plantations as an available source of rubber, the cost of cultivation being very slight after the first year, and the profit commencing in seven years, at which age the yield is calculated to be three and a half pounds.

Penang rubber in character resembles the Assam, and may be also supposed to be obtained from a species of *Ficus*.

Java rubber is stated by Doctor De Vrij to be obtained from *Ficus elastica*. Like the Assam rubber it is dark and glossy, but it is of a deeper tint, and has occasional reddish streaks. It is said to be prepared by allowing the juice to dry on the incisions made in the tree. Singapore, Java, and Penang rubbers are much alike in character, and may be classed with the Assam rubber, having a firm texture, mottled appearance, and bright, polished surface, but varying in color in a single sample from light yellowish-white to dark brown. Java rubber is also exported to France.

Caoutchouc is obtained in the Malay archipelago from *Alstonia costulata*, Miq.; and *Alstonia scholaris*, R. Br., is likewise reported to yield it. In Fiji it has been obtained from *Alstonia plumosa*, Labill. In North Australia caoutchouc has been prepared from *Ficus macrophylla*, Desf., and *F. rubiginosa*, Desf.; the last-named plant has been recommended by Baron Müller as suitable for cultivation, being a hardy species. None of the above rubbers are as yet known in British commerce as regular articles of trade.

The remarkable body known as india-rubber is composed of carbon and hydrogen alone, but its exact chemical nature is not by any means known with certainty. The action of cold and heat on india-rubber presents many points of interest. When exposed to a temperature approaching 0° C., it gradually loses its softness and ready extensibility, and finally becomes

rigid and inelastic; but its normal condition may be restored by submitting it either to a temperature of 35° or 40° C., or to a tension sufficient to stretch it to about twice its natural length. In the latter case it is probable that the change is really due to heat arising from the physical disturbance consequent upon the act of stretching. The effects of heat are more complex and varied than those of cold; and with caoutchouc at an ordinary temperature, say 15° C., the primary effect of heat is to increase its flexibility and elasticity. This is well illustrated by the fact that a strip of rubber stretched by a weight contracts when it is heated to a temperature of about 40° C. This diminution as regards length is, however, accompanied by a more than corresponding increase in thickness, on account of the expansion in volume due to an elevated temperature. When caoutchouc is exposed to a temperature ranging between 100° and 120° C., it becomes considerably softened, and almost entirely loses its elasticity; but, if of good quality, it slowly recovers its former condition under the influence of a moderate degree of cold. When, however, the heat is pushed to 150° , it becomes viscous, and at 200° it fairly melts, forming a thick liquid which possesses the same composition as ordinary caoutchouc, but has no tendency to resume its original condition even when exposed to cold for a prolonged period. At a still higher temperature, caoutchouc yields a variety of volatile hydrocarbons; and, on subjection to dry distillation in a retort, its conversion into these bodies is tolerably complete, only a trifling carbonaceous residue remaining behind.

Caoutchouc, when pure, is odorless and nearly white, and possesses a specific gravity of .915. It is porous and cellular in texture, and absorbs from 10 to 25 per cent. by weight of water when long soaked in it. Alcohol is similarly taken up. Up to this point caoutchouc has been referred to as if it consisted of one substance only; but as a matter of fact all ordinary samples contain two distinct modifications, viz., the hard or fibrous and the soft or viscous. These two caoutchoucs are identical in composition, and similar as regards general properties and reactions. On subjecting a piece of raw caoutchouc, however, to the action of such a solvent as cold benzol, the essential difference between the two forms manifests itself. The fibrous or hard constituent merely swells up to many times its original bulk, but the viscous yields a true solution. In a high-class rubber, such as that imported from the province of Pará, the former modification is the principal factor; in a caoutchouc of low quality, such as "African tongue," the latter. Freshly cut surfaces of caoutchouc unite together firmly, and this circumstance is due to the presence of the viscous variety; vulcanization, by hardening this, destroys the adhesive property.

Certain liquids, such as benzol and its homologues, carbon disulphide, petroleum, ether, volatile oils, chloroform and melted naphthalene, dissolve caoutchouc more or less perfectly; but unless the substance has been subjected to the process of mastication, its fibrous constituent appears, not to dissolve in the strict sense of the term, but rather to swell up, forming a paste analogous to starch which has been acted on by hot water. Carbon disulphide and chloroform, however, exercise a more powerful solvent action on the fibrous parts of india-rubber than benzol or essential oils; and Payen has found that carbon disulphide to which 5 per cent. of absolute alcohol has been added forms one of the best solvents. One part of masticated caoutchouc dissolved in thirty parts of this solvent forms a liquid which can be filtered through paper, and which leaves a film of exquisite tenuity and purity when allowed to dry on a level glass plate.

Most fatty matters exercise a remarkable destructive action on caoutchouc, causing it to become first soft, and afterward hard and brittle. It has often happened that traces of fatty oils in the liquids employed for dissolving india-rubber, or fatty matters in the textile basis, have led to the destruction of waterproof goods. A like cause has in many cases led to the rapid deterioration of the caoutchouc threads in elastic webbing.

In the industrial working of india-rubber, the first matter to be attended to is the removal of the various impurities present in the crude material. These are in some cases natural products which have originated with the caoutchouc, while in other cases they owe their presence to careless collection or to adulteration. Among the impurities of the former class may be mentioned various gum-like or mucilaginous matters, and acid products arising from their decay or oxidation.

All impurities are in actual practice very efficiently removed by the following process:—The lumps of crude caoutchouc are first softened by the prolonged action of hot water, and then cut into slices by means of a sharp knife, generally by hand, as thus any large stones or other foreign substances can be removed. The softened slices are now repeatedly passed between grooved rollers, known as the washing rollers, a supply of hot or cold water being made to flow over them. Solid impurities speedily become crushed, and are carried away by the water, while the rubber takes the form of an irregular sheet perforated by numerous holes. The washed product contains in its pores a notable proportion of water, which is removed by hanging the rubber for some days in a warm room. It is now ready either for incorporation with sulphur and other solid bodies, or for agglomeration into solid masses by means of the masticating machine, an apparatus which consists of a strong cylindrical cast-iron casing, inside which there revolves a metal cylinder with a fluted or corrugated surface. Some of the rubber having been placed in the annular space between the inner cylinder and the outer casing, the former is made to revolve; and the continued kneading action to which the rubber is subjected works it into a solid mass, something like a gigantic sausage. Before commencing the mastication it is generally necessary to warm the apparatus by means of steam; but as the operation proceeds the heat produced requires to be moderated by streams of cold water flowing through channels provided for the purpose. The inner cylinder is generally placed somewhat eccentrically in the outer casing, in order to render the kneading more perfect than would otherwise be the case.

To convert the masticated rubber into rectangular blocks, it is first softened by heat, and then forced into iron boxes or molds. The blocks are cut into thin sheets by means of a sharp knife, which is caused to move to and fro about two thousand times per minute, the knife being kept moistened with water, and the block fed up to it by mechanical means. Cut sheets are largely used for the fabrication of certain classes of rubber goods, these being made by cementing the sheets together with a solution of rubber in coal-naphtha or benzol. Most articles made of cut sheet rubber would, however, be of very limited utility were they not hardened or vulcanized by the action of sulphur or some compound of that element. After vulcanization, rubber is no longer softened by a moderate heat, a temperature of 160° C. scarcely affecting it, nor is it rendered rigid by cold, and the ordinary solvents fail to dissolve it. It must, however, be distinctly understood that it is not the mere admixture, but the actual combination of sulphur with india-rubber that causes vulcanization. If an article made of cut sheet be immersed for a few minutes in a bath of melted sulphur, maintained at a

temperature of 120°C ., the rubber absorbs about one-tenth of its weight of that element, and, although somewhat yellowish in color from the presence of free sulphur, it is still unvulcanized, and unaltered as regards general properties. If, however, it be now subjected for an hour or so to a temperature of 140°C ., true combination sets in, and vulcanized caoutchouc is the result.

The ordinary mackintosh or waterpoof cloth is prepared by spreading on the textile fabric layer after layer of india-rubber paste or solution made with benzol or coal-naphtha. If cotton or linen is used, it is usual to incorporate sulphur with the paste, and to effect vulcanization by steam heat; but, when silk or wool is employed, no sulphur is added to the paste, the dried coating of rubber being merely brought into momentary contact with the mixture of chloride of sulphur and carbon disulphide already mentioned. Double texture goods are made by uniting the rubber surfaces of two pieces of the coated material. Air goods, such as cushions, beds, gas bags, and so forth, are made of textile fabrics which have been coated with mixed rubber either by the spreading process above described, or by means of heated rollers, the curing being then effected by steam heat. The manufacture of overshoes and fishing boots is an analogous process, only the canvas base is more thickly coated with a highly pigmented rubber of low quality. The articles are first fashioned by joining the soft material; they are then varnished, and afterward cured in ovens heated to about 135°C . The fine vulcanized "spread sheets" are made by spreading layers of india-rubber solution, already charged with the requisite proportion of sulphur, on a textile base previously prepared with a mixture of paste, glue, and treacle. Vulcanization is then effected by steam heat, and, the preparation on the cloth being softened by water, the sheet of rubber is readily removed. The required thickness of the spread sheet is very often secured by the rubber-faced surfaces of two cloths being united before curing. The threads used in making elastic webbing are usually cut from spread sheets. The manufacture of springs, valves, and washers does not require any very special notice, these articles being generally fashioned out of mixed rubber, and vulcanized either in molds or in powdered French chalk. Rollers are made to adhere to their metal spindles by the intervention of layers of ebonite, and after vulcanization they are turned. In order to make spongy or porous rubber, some material is incorporated which will give off gas or vapor at the vulcanizing temperature, such as carbonate of ammonia, crystallized alum, and finely-ground damp sawdust. Uncombined sulphur is injurious, and often leads to the decay of vulcanized goods; but an excess of sulphur is generally required in order to insure perfect vulcanization. Sometimes the excess is partially removed by boiling the finished goods with a solution of caustic soda, or some other solvent of sulphur. In other cases the injurious effects of free sulphur are obviated by using instead of it a metallic sulphide—generally the orange sulphide of antimony; but, for the best result, it is necessary that this should contain from 20 to 30 per cent. of uncombined sulphur.

INDICTMENT is a formal accusation in writing, laid before a grand jury, and by them presented on oath to a court of competent jurisdiction. It is thus distinguished from a mere presentment by the grand jury made on information within their own knowledge, and from an INFORMATION (*q. v.*), by which a prosecution is instituted at the suggestion of a public officer without the intervention of a grand jury. The grand jury hears in private the witnesses in support of the application, and if it considers that a *prima facie* case has been made out,

it is its duty to find the indictment "a true bill." Otherwise it sends the indictment into court with a finding of "no bill." In this case the indictment is said to be ignored. An indictment is said to consist of three parts—the commencement or caption, the statement of the facts constituting the crime, and the conclusion. In each part appropriate and highly technical language is still used, but verbal precision is not so essential as it once was, and departure from the ordinary formalities, if it involves no misapprehension or mistake, does not generally make a flaw in the indictment.

INDIGO is a well known and exceedingly valuable blue dyeing material. The substance has been known among Western communities from an early period, being mentioned by Dioscorides and by Pliny as *Indicum*; when it made its appearance in England it was called indico. As all these names show, the material in its origin and production is closely related to India, among the commercial commodities of which it has always occupied a distinctive and important place. It was not, however, till after the establishment of the Cape route to India that indigo came to be largely used in the dyeing establishments of Western Europe, woad having in earlier times been utilized for purposes to which indigo was subsequently applied.

As a commercial substance indigo is entirely obtained from the vegetable kingdom, although it may be produced, in minute quantity, from a principle contained in urine, and its synthetical formation has also been accomplished. The number of plants from which indigo may be procured is known to be large, but only from a very few is it prepared in practice. These are various species of the leguminous genus *Indigofera*, especially the four species *I. tinctoria*, *I. Anil*, *I. disperma*, and *I. argentea*; and it is said that in China *Polygonum tinctorium* and other nonleguminous plants are used as the source of *lan* or Chinese indigo. The woad plant, *Isatis tinctoria*, owes its value as a dye to the presence of indigo matter, although indigo is not actually prepared from it. The most important source of indigo, and that most generally cultivated, is *I. tinctoria*, which is an herbaceous plant growing three to five feet high, and having bipinnate leaves. It is in the leaves that the indigo-yielding principle chiefly resides, and these are most gorged with it at the period when the flower-buds are about to open. It is then that the plant is cut down; and in some regions the same stock yields in one year a second and even a third crop of stems.

Two principal methods of preparing indigo are pursued—dried leaves being operated on in the one, while the fresh green stalks and leaves are used in the other. It will be sufficient to describe the latter, the more important process, as it is conducted in Bengal, where the most highly esteemed varieties of indigo are made. The cut leaves and stems are tied up into small bundles and conveyed at once to the factory, in which there are two ranges of large tanks or vats, one series being at a lower level than the other. In the upper or fermenting vats the bundles are submerged; and cross-bars are fixed over the vats. A fermentation more or less rapid ensues, its completion occupying, according to the temperature, from nine to fourteen hours. The progress of the operation is judged by the tint assumed by the water, which under favorable conditions should at the end of this stage be of a fine, clear, yellow color. In this condition the liquid is run off into the lower vats, in which it is necessary to maintain it in a state of violent agitation. For this purpose a number of men, armed with long bamboos, enter the vats and lash the water incessantly for two or three hours, thus constantly exposing new surfaces to the air. Gradually the liquid assumes a green color, and indigo appears in broadish

flakes, which as it forms begin to sink. After this transformation is complete, the liquid is allowed to settle, and as the indigo sinks, the clear liquid is drawn off in a series of discharges by pipes at different heights in the vat. The deposit of indigo is then placed in a boiler, and, to prevent any further fermentation, is raised to the boiling point. After resting for about a day, it is boiled for three or four hours, and then filtered over a thick filtering cloth, and the paste is dried by pressure. The cakes formed during the pressing are then put away to dry gently in the shade, and in a few days are ready for packing.

Bengal indigo of good quality forms a porous earthy mass, light and easily pulverized; and when newly fractured it has that brilliant purple-blue color distinctively known as indigo, with a kind of coppery luster. Experts distinguish upward of forty qualities of Bengal indigo, principally characterized by varying shades of color, the inferior qualities being dull in hue, with greenish or grayish tones, hard, dense, and not readily broken. The varieties of indigo which come into the American markets are classified according to their sources; the classes most frequently met with are Bengal, Oude, Madras, Manila, Java, Egypt, Guatemala, Caraccas, Mexico, and Brazil. The best qualities are the Bengal, Java, and Guatemala.

INDIUM, a metal discovered with the aid of the spectroscope in 1863 by Reich and Richter when testing certain specimens of Freiberg zinc-blende for thallium. Instead of the brilliant green line characteristic of this latter metal, they observed an intense indigo-blue line occupying a position different from that of any known line, and were thus at once led to suspect the presence of a previously unknown element. The name indium was chosen for the metal, when they succeeded in isolating it, on account of this circumstance. It has since been detected in blendes from various sources, but always in extremely minute amount, and still remains one of the rarest of the elements. Indium is best prepared from crude zinc made from indium-containing blendes. As it is less positive than zinc, if the crude zinc is treated with insufficient hydrochloric acid to dissolve it completely, a residue is obtained containing all the indium together with several other metals also present in small quantity in the zinc.

INDORE, or the Territories of the Mahārāja of Holkar, is one of the principal native states in India, under the Central India Agency. The name of the state is taken from that of the capital Indore. The territory consists of many isolated tracts; but since 1861 arrangements have been made to concentrate the state as much as possible, and lands which were formerly held by Holkar in Ahmednagar district and in the Deccan have been exchanged for districts and *pārgānās* bordering on the Nerbudda (Narbada) river and the tract in which Indore town is situated. The area of the whole of Holkar's territories is estimated at 8,075 square miles. Of these districts, those situated to the north are drained by the river Chambal and its feeders, those to the south by the Nerbudda. The tracts are fertile, producing in abundance excellent wheat and other grains, pulse, sugar-cane, cotton, and opium. The poppy is so generally cultivated that, when in bloom, it gives the country the appearance of a vast garden. Tobacco is also grown to a great extent, and is of admirable quality.

Besides the ruling tribe of Marhattās, the population comprises many other classes of Hindus, a few Mahometans, and a considerable number of Gonds and Bhils.

INDRE, a department of central France, consisting of parts of the old provinces Bas-Berry, Orléanais, and Marche, is bounded north by the departments of Indre-

et-Loire and Loir-et-Cher, east by Cher, south by Creuse, Haute-Vienne, and Vienne, and west by Vienne and Indre-et-Loire. It derives its name from the river Indre, which flows through it from southeast to northwest. The total area is 2,624 square miles, and the population is 296,147.

INDRE-ET-LOIRE, a department of Central France, consisting of parts of the old provinces Touraine, Orléanais, Anjou, and Marche, is bounded north by the departments of Sarthe and Loir-et-Cher, east by Loir-et-Cher and Indre, south and southwest by Vienne, and west by Maine-et-Loire. It derives its name from the Loire and its tributary the Indre, which flow through it. The total area is 2,360 square miles, and the population is 340,921.

INDULGENCE, in Roman Catholic theology, is defined as the remission, in whole or in part, by ecclesiastical authority, to the penitent sinner, of the temporal punishment due for sin. The word (from *indulgeo*, and perhaps connected with *dulcis*) in its classical use has the meaning which it still bears in ordinary parlance; but by post-classical writers it is often employed in a more special sense to denote a remission of taxation or of punishment.

Indulgences are either general or particular, *i.e.*, either open to the whole church or confined to particular localities. The most general of all is that which is proclaimed in the year of jubilee. Indulgences again are either plenary or non-plenary, the former being a total remission of all the temporal punishment which may have been incurred by the recipient. It must carefully be borne in mind that, in Roman Catholic orthodoxy, indulgence is never absolutely gratuitous, and that those only can in any circumstances validly receive it who are in full communion with the church, and have resorted to the sacrament of penance, in which alone, after due contrition and confession, provision is made for the remission of the graver penalty of sin. The doctrine of indulgences, however, is singularly open to misunderstanding; and in its practical applications it has too often been used to sanction the most flagrant immorality. The scandalous abuses connected with the "pardoners' trade, and in particular the reckless conduct of the hawkers of the papal indulgence granted to those who should contribute funds for the completion of St. Peter's, Rome, were, as is well known, very prominent among the proximate causes of the Protestant Reformation. In the 14th article of the Church of England the doctrine of the "thesaurus meritorum" or "thesaurus supererogationis perfectorum" is by implication rejected; and in article 22 "the Romish doctrine concerning purgatory and pardons" is expressly condemned. It is hardly necessary to add that "the power of the keys" is inseparable from the idea of a church, and that in this power is plainly involved a certain discretion as to the time and manner in which discipline shall be administered. This discretion is claimed by every organized body of Christians.

INDUS, one of the three greatest rivers of northern India, rises in unknown regions on the northern slopes of the sacred Kailas Mountain in the Himālayas. On the south of this same hill rises the Sutlej, the great feeder of the Indus, which unites with it after a separate course of about 1,000 miles. The Indus rises in 32° N. latitude and 81° E. longitude, enters the Punjab in 34° 25' N. latitude and 72° 51' E. longitude, leaves the Punjab in 28° 27' N. latitude and 69° 47' E. longitude, enters Sird in 28° 26' N. latitude and 69° 47' E. longitude, and finally falls into the Arabian Sea in 23° 58' N. latitude and 67° 30' E. longitude. The basin of the Indus is estimated at 372,700 square miles, and its total length at a little over 1,800 miles.

The delta of the Indus covers an area of about 3,000 square miles, and extends along the coast-line for 125 miles. It is almost a perfect level, and nearly destitute of timber, the tamarisk and mangrove alone supplying fuel. In the marshy portions good pasturage is obtained, and in the drier rice grows luxuriantly. The climate of the delta is cool and bracing in the "winter" months, excessively hot in the "summer," and most healthy during the floods.

The Indus begins to rise in March, attains its maximum depth and width in August, and subsides in September. The registered rise at Gidu-Bandar is fifteen feet. Fish abound—at the mouths, the saltwater varieties, notably the *Clupea neowhii*, a species of herring; the chief of the freshwater varieties is the *pala*. The local consumption and export of the dried *pala* are both very large. The boats of the Indus are the *dúndhi* and *zaurak* (cargo boats), the *kauntál* or ferry boats, and the *dúndo* or fishing boats.

INDUSTRIAL EXHIBITIONS. Exhibitions of the agricultural products, mechanical inventions and works of art of different countries have grown from small beginnings within the past century and a half. Their prototypes may be found in the annual market fairs of the Middle Ages, and a survival of the original may still be noted at Nijni-Novgorod, which for a few weeks of every year becomes a populous town, its bazaars thronged by a hundred thousand visitors of many races. In 1761 the London Society of Arts gave an exhibition of pictures which has been held annually ever since. Agricultural fairs in the United States began with one given in 1804 at Washington, D. C., and have spread to every State in the Union. France, as becomes an artistic nation, was the first to inaugurate exhibitions of porcelain, tapestry, and other high-class productions. During the first half of this century national exhibitions, covering many branches of art, science, manufactures and natural products, were held in European countries, and at New York and Washington. But the era of great national and international displays, soon to culminate in the Columbian World's Fair, by which the United States will celebrate the quadricentennial of the discovery of the continent, must be properly held to have begun with the great English exhibition held in Hyde Park, London, in 1851. This was the first "International" or "World's Fair," and was an enormous success, both from an educational and a financial stand-point. At this exhibition the combination of iron and glass in the construction of the exhibition halls was first introduced on a gigantic scale. The main building was 1,848x408 feet, with a floor area of almost a million square feet, and nearly 14,000 exhibitors contributed to make it the finest and fullest display up to that time known.

The New World followed with the second of the international series, held at New York in 1853. This, although on a much smaller scale than its London predecessor, was valuable as being the first great exhibit of American industries. Paris in 1855, London in 1862, Paris again in 1867, and Vienna in 1873, presented exhibitions of great merit and importance, the second exhibition at Paris and the display at Vienna outranking anything of the kind in history. All of these, however, were to be eclipsed in turn by the Centennial Exposition of the world's industries held at Philadelphia in 1876. A space of 260 acres in Fairmount Park was devoted to this magnificent exhibition, at which, for the first time, the immense progress in arts and science, in machinery and the products of the soil and the mine, made by the United States, were made manifest to the world at large. There were 147 structures devoted to the uses of this exposition, of which the chief were the Main Building,

Agricultural Hall, Machinery Hall, Horticultural Hall, Memorial Hall, the Woman's Pavilion, and the Government Building. The main building was 1,880x464 feet, with a floor area of 20 acres; its main avenue being 1,832 feet long and 120 feet wide, with two side avenues of the same length, and 100 feet wide. The building was constructed of wrought-iron columns supporting trusses of the same material; the sides of glass, resting on brick. Of the nearly 700,000 feet taken by exhibitors, 310,000 feet were devoted to exhibits from the United States. Machinery Hall was 1,402x306 feet, with a floor area of 15 acres, and Agricultural Hall furnished 10 acres of room for exhibits. Thirty-six foreign governments accepted the invitation of the United States to participate in this great display, which was opened on May 10, 1876, and remained open for six months. More than 40,000 exhibitors contributed, and almost 10,000,000 of visitors attended.

Two years later Paris gave her third exhibition, surpassing in size all previous efforts, and only to be excelled by Paris herself in the display made during 1889. The 1878 exhibition had 80,000 exhibitors and 16,000,000 visitors, and its buildings covered eighty acres. The great Exposition of 1889, which was visited by thousands of Americans, undoubtedly excelled, in richness and variety, in magnitude and in success, all previous efforts. It was held in the Champ de Mars, and one of its most noticeable features was the great Eiffel tower, almost 1,000 feet in height. Other expositions, more limited in their scope, have been held at South Kensington, London, and in many European cities. In 1881 Atlanta, Ga., and in 1883 Louisville, Ky., gave fine displays of Southern products, and in 1884-85 New Orleans made a grand exhibit at the "World's Industrial and Cotton Centenary Exposition." At this writing the preparations for a world's fair which shall transcend all its predecessors, and shall illustrate to the entire earth the triumphant advance of the United States in every branch of art and science, are being actively made, and the four hundredth anniversary of the discovery of the New World will witness the opening of the greatest world's fair of all the ages.

INFANT, in law, is a person under full age, and therefore subject to certain disabilities not affecting persons who have attained full age. The period of full age varies widely in different systems, as do also the disabilities attaching to nonage. In Roman law, the age of puberty, fixed at fourteen for males and twelve for females, was recognized as a dividing line. Under that age a child is under the guardianship of a tutor, but several degrees of infancy are recognized. The first is absolute infancy in the literal sense—speechlessness; after that, until the age of seven, a child is *infantia proximus*; and from the eighth year to puberty he is *pubertati proximus*. An infant in the last stage could, with the assent of his tutor, act so as to bind himself by stipulations; in the earlier stages he could not, although binding stipulations could be made to him in the second stage. After puberty, until the age of twenty-five years, a modified infancy was recognized, during which the minor's acts were not void altogether, but voidable, and a curator was appointed to manage his affairs. The difference between the tutor and the curator in Roman law was marked by the saying that the former was appointed for the care of the person, the latter for the estate of the pupil. These principles of course apply only to children who are *sui juris*. The *patria potestas*, so long as it lasts, gives to the father the complete control of the son's actions; and tutorship and curatorship were devices for protecting those who were free from the *potes-tas*, but unable by reason of infancy to control their own affairs. The right of the father to appoint tutors

to his children by will was recognized by the Twelve Tables, as was also the tutorship of the *agnati* (or legal as distinct from natural relations) in default of such an appointment. Tutors who held office in virtue of a general law were called *legitimi*. Besides and in default of these, tutors *dativi* were appointed by the magistrates. These terms are still used in much the same sense in modern systems founded on the Roman law, as may be seen in the case of Scotland, noticed below.

By the law of the United States full age is twenty-one, and all minors alike are subject to incapacities. The period of twenty-one years is regarded as complete at the beginning of the day before the birthday: for example, an infant born on the first day of January attains his majority at the first moment of December 31st. The incapacity of an infant is designed of course for his own protection, and its general effect is to prevent him from binding himself absolutely by obligations. In the matter of contracts the statement has generally passed current that an infant's contracts, except when they are binding for special reasons, are either void or voidable, *i. e.*, null, *ab initio*, or capable of being nullified by the infant at his choice. Contracts, for example, which cannot be beneficial to the infant are said to be absolutely void. A bond with a penalty is for this reason declared to be void. On the other hand, it is alleged by the more recent text-writers that the words void and voidable have not been carefully distinguished, and that a contract is often described as void when it is only meant that it is not binding. On this theory all the contracts of an infant might be described as voidable at his option except those few which are absolutely valid. On his voidable contract an infant may sue if he chooses to do so, but may not be sued. Of the contracts of an infant which are binding *ab initio*, the most important are those relating to "necessaries." The word is used in an extended signification to cover "articles fit to maintain the person in the particular state, degree, and station in life in which he is." Whether a particular thing is necessary or not is a question of fact to be decided by a jury, but it is for the judge to say whether it is *prima facie* of a description such that it may be a necessary.

At common law a bargain made by an infant might be ratified by him after full age, and would then become in all respects binding. It has been held in a recent case that this action applies to promises of marriage, so that where an infant had promised marriage, and after attaining full age had continued to recognize the promise, no action arose on the breach. But an actual contract of marriage may be lawfully made by persons under age. So, generally, an infant may bind himself by contract of apprenticeship or service. Infancy is in general a disqualification for public offices and professions, *e. g.*, to be a member of congress or an elector, a mayor or alderman, a priest or deacon, a barrister or solicitor, etc.

The custody of an infant belongs, in the first place, and against all other persons, to the father, who is said to be "the guardian of his children by nature and nurture," and the father may by deed or will dispose of the custody or tuition of his children until the age of twenty-one. If the father is dead, and has appointed no testamentary guardian, the mother is recognized as "guardian by nature and nurture."

INFANTICIDE. The history of infanticide as an archaic institution has already been referred to in the article **FOUNDLING HOSPITALS**. Children of each sex were sacrificed as religious offerings. Indeed, in some cases, *e. g.* in expiations for sacrilege, the boy, as being the nobler child, was preferred. But what may be called the normal infanticide of early society was probably confined to girls. The custom is in certain

places and for certain periods explained by the system of exogamy; but much more generally, as in China at the present day, it is simply an illustration of what Malthus would call a "positive check," the reckless propagation of children far outrunning the means of subsistence which the energy of the parents can provide. Infanticide still survives among many savage races; and where the necessity for strong warriors is felt, a selection is sometimes made of the weaker children for destruction. But this political element seldom enters into the custom. It is because girls cannot provide for themselves that they are killed.

More complex were the leading forms of infanticide in India, now suppressed by the wise action of the British government. The practice, though forbidden by both the Vedas and the Koran, prevailed among the Rájputs and certain of the aboriginal tribes. Among the aristocratic Rájputs, for example, it was thought dishonorable that a girl should remain unmarried. Moreover, a girl may not marry below her caste; she ought to marry her superior, or at least her equal. This reasoning was obviously most powerful with the highest castes, in which, accordingly, the disproportion of the sexes was painfully apparent. But, assuming marriage to be possible, it is ruinously expensive to the bride's father. He has to make gifts of money, clothes, jewels, and sweetmeats to the bridegroom's relatives; and when the marriage ceremony comes, he has, chiefly owing to the exactions of the Bráhmans and Bhats or minstrels, to face a lavish expenditure on feasts which in the case of some rájáhs has been known to reach more than £100,000. To avoid all this, the Rájput killed a certain proportion of his daughters—sometimes in a very singular way. A pill of tobacco and blang might be given to the newborn child to swallow; or it was drowned in milk; or the mother's breast was smeared with opium or the juice of the poisonous *Datura*. A common form was to cover the child's mouth with a plaster of cow-dung before it drew breath. Infanticide was also practiced to a small extent by some sects of the aboriginal Kandhs, and by the poorer hill tribes of the Himalayas. Where infanticide occurs in India, though it really rests on the economic facts stated, there is usually some poetical tradition of its origin. The measures against the practice were begun toward the end of the 18th century by Jonathan Duncan and Major Walker. They were continued by a series of able and earnest officers during the present century. One of its chief events, representing many minor events, was the Umritsur durbar of 1853, which was arranged by the late Lord Lawrence. At that great meeting the chiefs residing in the Punjab and the trans-Sutlej states signed an agreement engaging to expel from caste everyone who committed infanticide, to adopt fixed and moderate rates of marriage expenses, and to exclude from these ceremonies the minstrels and beggars who had so greatly swollen the expense. According to the present law, if the female children fall below a certain percentage in any tract or among any tribe in northern India where infanticide formerly prevailed, the suspected village is placed under police supervision, the cost being charged to the locality. By these measures, together with a strictly enforced system of reporting births and deaths, infanticide has been almost trampled out; although some of the Rájput clans keep their female offspring suspiciously close to the lowest average which secures them from surveillance.

The modern crime of infanticide shows no symptom of diminution in the leading nations of Europe. In all of them it is closely connected with illegitimacy in the class of farm and domestic servants. The crime is generally committed by the mother for the purpose of

completing the concealment of her shame, and in other cases, where shame has not survived, in order to escape the burden of her child's support. The paramour sometimes aids in the crime, which is not confined to unmarried mothers. The ease with which affiliation orders are obtained in Great Britain must save the lives of many children. In France, where the inquiry into paternity is forbidden, a controversy still goes on as to the influence of hospitals for "assisted children," which are said to save life at the expense of morality. It seems certain that the great administrative change involved in closing the "tour" at these hospitals has not perceptibly affected infanticide in France. The laws of the European states differ widely on this subject—some of them treating infanticide as a special crime, others regarding it merely as a case of murder of unusually difficult proof.

It is a statutory offense to administer poison or any noxious thing to a woman with child with intent to procure her miscarriage, or to use any instrument for the same purpose. The law has not yet succeeded in putting down the degraded and wicked trade in abortion. There can be no doubt from the French and American treatises of Gallard and Storer that the crime prevails extensively, and even in classes of society in which infanticide proper would not be thought of without a shudder.

INFANTRY, AMERICAN. The military strength of the United States has of recent years been the subject of much interest. Based on actual enrollments during the late war the estimates give us a total war strength far exceeding the numbers of available forces of any other nation on earth. The standing army is insignificant, as far as regards numbers, and is more designed as a nucleus around which to group such vast bodies of men as surprised the world during the period above referred to. The army, while embracing in its organization the three branches of infantry, artillery, and cavalry, is for the most part composed of infantry, and this branch of the service is the one most and best nurtured in the various national guards of the different states. A short account, therefore, of the organization, *personnel*, and equipment of our infantry will not be devoid of interest. The tactical unit of our army is the company. On a war basis the company consists of 100 men. On a peace footing the company generally consists of fifty private soldiers, captain, two lieutenants, five sergeants, four corporals, two musicians, two artificers, one wagoner. The president of the United States may on special occasion increase the number of men in a company up to 100. The army of the United States consists entirely of volunteers, enlisted at various points of the country by recruiting officers detailed specially for that duty. These recruits must be able-bodied men not older than thirty-five years nor younger than sixteen, at the time of initial enlistment. Once enlisted a man can continue his connection with the army till he can no longer perform military duty.

The term of enlistment is generally for five years. When the company is full it is generally divided into two bodies called platoons, each platoon being under the command of a lieutenant. The men are generally arranged according to height, with a corporal at either end of the platoons. There are two ranks of men, one behind the other, this arrangement being styled "double rank" formation. The companies in the standing army, usually being small, are not generally formed on the platoon basis, but generally in only one rank, this being called the "single rank" formation. The company marches either in line or in column of fours. The men in the line, after being drawn up, begin at the right and count off successively in sets of fours, these sets becom-

ing the unit of company maneuvers, and marching abreast in column formation. Ten companies compose a regiment, which is commanded by a colonel. The other members of a regimental organization are a lieutenant-colonel, a major, an adjutant, a quartermaster, a sergeant-major, a quartermaster-sergeant and three musicians. In the negro regiments a chaplain is added to the regimental officers and ranks as a captain, but cannot take command of troops. All officers above the grade of sergeant (including chaplains) are commissioned officers, and receive their commissions from the President, with the consent of the Senate. The sergeants and all inferior officers are non-commissioned and are appointed by the regimental commander, who gives them his "warrant" of authority, which must be countersigned by the adjutant. The non-commissioned company officers are generally appointed on recommendation of the company commanders. The first sergeant is selected by his captain from among the sergeants so appointed, and he may be degraded from first to duty sergeant by the captain without reference to any other authority. Any portion of a regiment (greater than two companies) arranged for tactical maneuver is called a battalion. Two companies form a division. The general formation of a battalion is in line, the men being in double rank. The field and staff officers are mounted and the adjutant is on foot. The senior officer present takes command. There is generally but one battalion in an American regiment, differing thus from European armies, the regiments in the latter being generally divided into three battalions. A movement is now on foot to increase the strength of the regiments and the number of battalions to each. Under this arrangement the peace footing of a regiment will be 600, and its war strength double this number. The color guard of a regiment consists of a color sergeant and seven corporals, and is posted as the left fours in the two ranks of the right center company. The color-sergeant carries the national colors while the regimental colors (when present) are carried by a sergeant (to the left of the color-sergeant) who takes the place of one of the seven corporals mentioned above. The next unit of division above the regiment is the brigade, which is generally composed of four regiments or battalions. There are other tactical bodies, but all above the brigade contain other arms of the service, artillery and cavalry, and hence do not fall within the scope of our present article. Following we give the arms, equipment and pay of the infantry soldier in the regular army:

PAY OF INFANTRY SOLDIER, UNITED STATES ARMY, PER MONTH.

Year in each enlistment	First enlistment.					First re-enlistment.				
	1	2	3	4	5	1	2	3	4	5
Year of total continuous service	1	2	3	4	5	6	7	8	9	10
Amount retained per month till expiration of service.....	00	00	\$1	\$2	\$3	\$1	\$1	\$1	\$1	\$1
Private or musician...	\$ 13	\$ 13	\$ 14	\$ 15	\$ 16	\$ 18	\$ 18	\$ 18	\$ 18	\$ 18
Wagoner	14	14	14	14	14	14	14	14	14	14
Artificer.....	15	15	15	15	15	15	15	15	15	15
Corporal	15	15	16	17	18	20	20	20	20	20
Sergeant	17	17	18	19	20	22	22	22	22	22
First sergeant	22	22	23	24	25	27	27	27	27	27
Principal mus'n (reg't)	22	22	23	24	25	27	27	27	27	27
Chief musician....	60	60	60	60	60	60	60	60	60	60
Sergeant-major... "	23	23	24	25	26	28	28	28	28	28
Quartermas. serg't "	23	23	24	25	26	28	28	28	28	28

For subsequent re-enlistments, \$1 per month more.

In case of re-enlistment *not continuous with original enlist-*

ment, the pay is \$16 for private or musician; for higher grades the standard increase as in other cases.

The *retained* pay is given to the soldier, in lump, at the expiration of his five years' enlistment.

Soldiers retired for age are allowed three-fourths of the pay of the grade they held when retired, together with commutation of clothing and rations.

Equipment of infantry soldier, United States army, for field service, in addition to the clothing worn: One rifle and bayonet; one cartridge belt; fifty cartridges; one bayonet scabbard; one canteen; one haversack; one clothing bag containing one shirt, one drawers, one blanket, one hold-all (soap, etc.); one yoke for clothing bag; one overcoat; one piece of shelter tent. Total weight, thirty-four pounds thirteen ounces.

INFINITESIMAL CALCULUS. The mathematical and physical sciences owe their present development to the introduction of infinitesimal calculus. The power, for example, of that calculus as an instrument of analysis has vastly extended the science of geometry, so that the investigations of the ancient Greeks go but a short way into the field of knowledge which has been laid open by the modern method; the discoveries of Archimedes and Apollonius are now easy deductions from its more extended results.

So long as the early geometers confined their speculations to the comparison of the areas of rectilinear figures they encountered little difficulty. They readily showed that the determination of the area of any such figure can be reduced to that of a rectangle, or of a square, and thus be completely effected. This process of finding areas was named the "method of quadratures." It failed, however, when they attempted to determine the areas bounded by curved lines, or the surface of the elementary solids such as the right cone and the sphere. In treating of these the ancients found it necessary to introduce new notions and modes of demonstration into geometry, and the difficulty of comparing the areas of curvilinear with those of the rectilinear figures gave rise to the "method of exhaustions." The fundamental principle of this method consists in conceiving the continual approach of two varying magnitudes to a fixed intermediate magnitude, with which they never become identical, though they may approach it to within less than any assignable difference. For example, a polygon may be inscribed in a circle, and another circumscribed to it, each differing from it by less than any assignable area; hence the ancients may have concluded that areas of circles have to each other the same ratio as the similar polygons inscribed in or circumscribed to them—that is, the ratio of the squares of the radii. But, as this kind of proof was of a different nature from that by which the more elementary doctrines were established, the Greek geometers fortified it by a *reductio ad absurdum*—proving, in the above example, that the square of the radius of one circle is to that of another as the area of the former is to a space which is neither less nor greater than the latter, and therefore exactly equal to it.

During nearly two thousand years no new method enabled mathematicians to rise to a higher generality than that attained in the works of the great Greek geometers. The celebrated Kepler was the first to extend the results of Archimedes. In his treatise entitled *Nova Stereometria Doliorum* (1615), he discussed a number of solids of revolution—for example, those formed by the revolution of a conic section about any ordinate, or a tangent at the vertex, or any line within or without the curve. Thus he considered some ninety new solids, and proposed problems concerning them; of these problems he resolved only a few of the most simple. In this treatise he introduced for the first time the name and notion of "infinity" into the language of geometry. Thus, he considered a circle as composed of an "infinite" number of triangles, having their common vertex at the center, and forming the circumference by their bases. In like man-

ner he regarded a cone as composed of an infinite number of pyramids, having their vertices at its vertex, and standing on an infinite number of triangular bases, bounded by the circular base of the cone. It may also be noted that Kepler was the first to observe that the increment of a variable—the ordinate of a curve, for example—is evanescent for values infinitely near a maximum or minimum value of the variable. This remark contains the germ of the rule for determining "maxima" and "minima," given by Fermat about twenty years subsequently.

Several years after Kepler had given his method of determining volumes of revolution, another celebrated theory, of similar kind—the "geometry of indivisibles" (1635) of Cavalieri, professor of geometry at Bologna—marks an epoch in the progress which science has made in modern times. In this work lines were considered as composed of an infinite number of points, surfaces of lines, and solids of surfaces. For example, if the perpendicular of a triangle be divided into an infinite number of equal parts, and through each point of division a line be drawn parallel to the base and terminated by the sides, then, according to Cavalieri, we may consider the area of the triangle as the sum of all these parallel lines, regarded as its elements. Again, as these parallels form a series in arithmetical progression, of which the first term is zero, this sum is represented by half the product of the last term and the number of terms. Now the base is the last term, and the altitude measures the number of terms; thus he deduced the ordinary expression for the area of a triangle. Cavalieri applied his method to a number of problems, such as finding the volumes of pyramids, the areas of certain simple curves of the parabolic species, the determination of centers of gravity, etc.; and it is remarkable that he was the first who gave an accurate demonstration of the well-known properties of the center of gravity, originally announced by Pappus, but commonly called Guldin's theorems. It is accordingly to Cavalieri, and not to Guldin, that the credit is due of having made the first advance beyond Pappus. Cavalieri's method is analogous to that employed in the integral calculus, the "indivisible" being that which has since been styled the "differential element" of the integral.

The method of Cavalieri was severely criticised by some of his contemporaries, more especially by Guldin. They alleged that, since a line has no breadth, no number of right lines, however great, when taken together, could make up a plane area. This objection was answered by Cavalieri; but the reply was stated in the clearest form by Pascal, who observed (letter to M. de Carcavi, 1658) that the method of indivisibles possessed all the rigor of that of exhaustions, from which it differed only in the manner of expression, and that, when we conceive an area as a sum of a system of parallel ordinates, we mean in reality an indefinite number of rectangles under the several ordinates, and the small equal portions into which we conceive the common perpendicular to these ordinates to be divided. This passage is remarkable—as was well observed by Carnot—as it shows that the notion of mathematical infinity, as now employed, was not strange to the geometers of that time; for it is clear that Pascal employed the word "indefinite" in the same signification as we now attach to the word "infinite," and that he called "small" that which is now called "infinitely small," also that he neglected these small quantities in comparison with finite quantities—thus he regarded as simple rectangles the small portions of the area of the curve comprised between two consecutive ordinates, neglecting the small triangles which have for their bases the differences of these ordinates. Carnot

adds that no person attempted to reproach Pascal with want of rigor in his demonstrations.

Pascal applied the method of Cavalieri with eminent success to the investigation of properties of the cycloid, and other problems. His researches, according to D'Alembert, closely approach to the integral calculus, and form the connection between the methods of Archimedes and of Newton.

The most important application, however, of Cavalieri's method was that of Wallis, Savilian professor at Oxford, who, in 1655, gave an admirable specimen of this method in his *Arithmetica Infinitorum, sive nova Methodus inquirendi in Curvilinearum Quadraturam*. Pursuing Cavalieri's views, he reduced the problem of finding the areas of a large number of curves, and the volumes of solids of revolution, to the summation of the powers of the terms of arithmetical series, consisting of an infinite number of terms—or rather to the determination of the ratio of the arithmetical mean of all such powers of the terms to the like power of the last term.

For example, in the series of square numbers 0, 1, 4, 9, 16, etc., the ratio of the mean to the last is, for the

first three terms, $\frac{0+1+4}{4+4+4} = \frac{1}{3} + \frac{1}{12}$; for the first four,

$\frac{0+1+4+9}{9+9+9+9} = \frac{1}{3} + \frac{1}{18}$; for the first five, $\frac{0+1+4+9+16}{16+16+16+16+16} = \frac{1}{3} + \frac{1}{24}$; in like manner the next fraction is $\frac{1}{3} + \frac{1}{30}$.

Hence, Wallis noticed that the fractions approach nearer and nearer to $\frac{1}{3}$; and, as the denominators in the fractions $\frac{1}{12}, \frac{1}{18}, \frac{1}{24}, \frac{1}{30}$ form an arithmetical series, with a common difference 6, it follows that, when the number of terms is indefinitely increased, the resulting fraction becomes ultimately $\frac{1}{3}$.

Wallis applied the same method to the series 0, 1³, 2³, 3³, etc., and found without difficulty that the aforesaid ratio is $\frac{1}{4}$ in this case; and so generally. He also introduced into analysis the notation of fractional indices instead of radicals, and extended his method of summation to series, proceeding by fractional powers of the natural numbers 1, 2, 3, etc. Wallis was enabled by these principles to obtain the areas of many curves, and the volumes of solids which had not been previously found.

Again, in his treatise *De Curv. rectific.* (1659), Wallis showed that certain curves were capable of being "rectified," or that straight lines might be found to which they were exactly equal, a remark which was very soon verified by a young English mathematician, William Neil, who, by Wallis' method, obtained, in 1660, the length of any arc of a semicubical parabola. This is the first curve that was rectified. The cycloid is the second; its rectification was effected by Sir C. Wren (*Phil. Trans.*, 1673). The methods we have thus far considered were more especially precursory to the integral calculus, having mainly reference to the quadrature of curves and cubature of solids. We now propose to consider the question of tangents to curves, in which the differential calculus may be said to have originated.

The great discovery of Descartes in his application of algebra to geometry (1637) imparted to the latter science the character of abstraction and generality which distinguishes modern from ancient geometry. By it the study of curves was brought under the domain of analysis, and instead of investigation being restricted to particular properties of a few isolated curves, as it had been hitherto, general views and methods applicable to all curves were introduced.

Hence the general problem of drawing tangents to curved lines started immediately into prominence. It

was found necessary to depart from the definition of tangents given by the ancient geometers, and to consider them in other points of view. A tangent, accordingly, came to be regarded either (1) as a secant of which the points of intersection became coincident; or (2) as the prolongation of the element of the curve, regarded as a polygon of an infinite number of sides; or (3) as the direction of the resultant motion by which the curve may be described. The first view was that of Descartes and Fermat; the second was introduced by Barrow, who thus simplified the method of Fermat; and the third was that of Roberval.

Descartes' method of drawing a tangent consisted in supposing a circle (whose center he placed on the axis of x) to cut the curve in two points; then, if the radius of the circle be supposed to decrease, *its center remaining fixed*, so that the points of section approach nearer and nearer and finally coincide, the circle will touch the curve; thus, by aid of the equation of the curve, the problem was reduced to one of finding the condition of equal roots in an equation. This method is remarkable as being the first general process of applying analysis to the problem of tangents; at the same time it is only capable of practical application in a small number of simple cases.

Many years subsequently (*Act. Erud. Lips.*, 1691) John Bernoulli extended Descartes' method with success to the problem of finding the center of curvature and the equation of the evolute of an algebraic curve. In his application he supposed the center of a circle taken on the normal to a curve, and *the center to vary* until *three* of the points of intersection of the circle with the curve became coincident, *i.e.*, so that the resulting equation should have three equal roots. Thus, for example, he showed, without difficulty, that the evolute of a parabola was a semicubical parabola. He also remarked that, when four roots coincide, the center of curvature becomes a cusp on the evolute.

It should also be noticed that we owe to Descartes the general method of drawing a tangent to a roulette.

Again, Descartes first introduced the method of indeterminate coefficients into analysis—a principle, as was ably shown by Carnot, which is of itself sufficient to establish by ordinary algebra the fundamental principles of the infinitesimal calculus.

The method of Fermat for drawing tangents was based on his method of maxima and minima. This latter was founded, as already observed, on a principle of Kepler's, *viz.*, that, whenever a magnitude attains a maximum or minimum, its increment, or diminution, for a very small change in the variable on which it depends, becomes evanescent.

Accordingly, to determine the maximum or minimum of any function of x , Fermat substituted $x + e$ instead of x , and equated the two consecutive values of the function; then, removing the common terms, and dividing by e , he made $e = 0$, and obtained an equation for determining the maximum or minimum value.

Thus adopting the modern notation, let $y = f(x)$, and $y_1 = f(x + e)$, then $f(x + e) - f(x) = 0$. Dividing by e ,

$$\frac{f(x + e) - f(x)}{e} = 0;$$

hence $f'(x) = 0$.

Thus the roots of the derived equation, $f'(x) = 0$, correspond to the maximum or minimum values of $f(x)$. Consequently we see that Fermat's rule agrees with that of the differential calculus, and in fact is the method of the calculus as applied to such cases.

In consequence of Fermat's both having introduced the conception of an infinitely small difference, and also having arrived at the principle of the calculus for deter-

mining maxima and minima, it was maintained by Laplace, Lagrange, Fourier, and other eminent French mathematicians that Fermat ought to be regarded as the first inventor of the differential calculus. In reply to this, we need but introduce the remark of their distinguished countryman Poisson, "that this calculus consists in a system of rules proper for finding the differentials of all functions, rather than in the use which may be made of these infinitely small variations in the solution of one or two isolated problems."

Fermat seems to have given no general demonstration of his method, but contented himself with giving particular applications of it to some problems of maxima and minima, as well as to finding the tangents to and the centers of gravity of a few curves.

Barrow, Newton's predecessor in the Lucasian chair of mathematics at Cambridge, simplified and extended

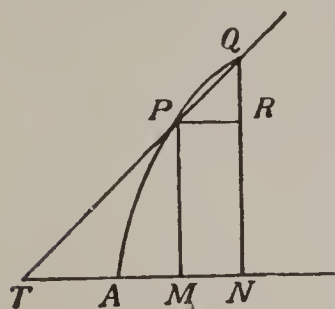


Fig. 1.

the method of Fermat, and advanced a step further in the development of the infinitesimal method, by the introduction of two infinitesimals instead of one in the problem of drawing a tangent. His method was as follows: Let x, y be the coördinates of a point P on a curve (fig. 1), and take Q an adjacent point; let $e = PR = MN$ be the increment of x , and $a = QR$ the increment of y ; then, substituting $x + e$ for x , and $y + a$ for y , in the equation of the curve, subtracting the equation of the curve for the original values, and rejecting all terms of the second and higher degrees in a and e , he obtained the limiting value of $a : e$, or of $PM : MT$, thus determining the value of the subtangent. The triangle PQR , which has for its sides the elements of the curve, of the abscissa, and of the ordinate, has been called Barrow's *differential triangle*.

The method of tangents of Roberval is based on the conception of the composition of motions, recently introduced by Galileo into mechanics, and depends on finding, from the properties of the curve, the different components of the motion of the point at which the tangent is required. The direction of the resultant of these motions determines that of the tangent. This method bears an analogy to Newton's method of "fluxions," but is very limited in its application on account of the impossibility of applying it except in a few cases. Roberval applied it successfully to the following curves—the parabola, hyperbola, ellipse, conchoid of Nicomedes, limaçon of Pascal, spiral of Archimedes, quadratrix, cissoid, cycloid, companion to the cycloid, and the parabola of Descartes.

We thus see that both in England and on the continent the principles of the infinitesimal calculus were being gradually developed. Their importance was seen and understood, and they were employed in extending the dominion of geometry. Nothing more was required but an appropriate notation to form them into a system. This was accomplished by Newton and Leibnitz, who appeared nearly at the same time in the field of discovery. In ascribing to each of these great men the full honor due to the merit of the invention of the calculus, it is proper to add that this is a question which at one time divided the opinions of the scientific world, and gave rise to a controversy which was agitated with great keenness for almost a whole century. There never could be any doubt as to Newton being the inventor of the calculus of fluxions; but the question strongly contested has been, whether Leibnitz invented his calculus independently, or borrowed it from the fluxional calculus, with which at bottom it is identical.

We next proceed to give a brief account of the notation and principles of the method of fluxions, as that which was first discovered.

The idea of a fluxion, as its name indicates, originated from that of motion, and all geometrical magnitudes were considered by Newton as capable of generation by continuous motion. Thus lines are conceived as generated by the motion of points, surfaces by that of lines, solids by surfaces, etc. Again, if we conceive a moving point as describing a curve, and the curve referred to coördinate axes, then the velocity of the moving point can be decomposed into two others, one parallel to the axis of x , the other to that of y ; these velocities are called the "fluxions" of x and y respectively, and the velocity of the point is the fluxion of the arc. Reciprocally, the arc is called the "fluent" of the velocity with which it is described; and the ordinates x and y are the fluents of their velocities respectively. Again, if the velocity of the moving point be regarded as constant, the fluxions of the abscissa and ordinate of any point on the curve (except in the case of a right line) will be variable; and their ratio at each instant will depend on the nature of the curve, *i.e.*, on the relation between the coördinates. Reciprocally, the relation between the coördinates depends necessarily on that which exists at each instant between their fluxions. Hence we may seek to determine the relation between the fluxions, when we know that which exists between the coördinates, *i.e.*, the equation of the curve; and reciprocally we may seek to discover the relation between the coördinates when we know that between their fluxions, either alone or combined with the coördinates themselves. The first part of the problem is called the "method of fluxions," and the second the "inverse method of fluxions."

Again, in the same case, not only do the coördinates x and y change, but also the subtangent normal, radius of curvature, etc.; that is to say, each of these quantities increases or decreases more or less rapidly, as well as the coördinates themselves. All these quantities, accordingly, have fluxions, whose ratios are also determined by the motion of the point. Consequently these quantities may in like manner be regarded as "fluents." Similar remarks apply to areas and surfaces regarded as fluents. Newton observes that he does not consider the time formally (*formaliter*), but supposes that one of the proposed quantities increases equably (*æquabili fluxu*), to which the others are referred (*tanquam ad tempus*). This fluent may be chosen at pleasure, and is what we now are accustomed to call the independent variable.

Again, if any quantities, regarded as fluents, be represented by letters, such as u, x, y, z , etc., the corresponding fluxions are represented by $\dot{u}, \dot{x}, \dot{y}, \dot{z}$, etc., respectively. Next, if u, x, y, z be regarded as variable or fluent quantities, their fluxions are represented by $\ddot{u}, \ddot{x}, \ddot{y}, \ddot{z}$, and are the fluxions of the fluxions of u, x, y , etc., *i.e.*, the second fluxions. If one of these, x for instance, be taken as the "principal fluxion," then x is a constant, and consequently $\dot{x} = 0$. In like manner we may have third fluxions, as well as those of higher orders.

Again, u, x, y , etc., may be regarded as themselves the fluxions of other quantities called their fluents. These quantities were represented by Newton, sometimes by u, x, y , etc., in other places by $[u], [x]$, etc.; and from them it may be desired to proceed to the fluents.

The infinitesimal calculus had in the outset its opponents, such as the Abbé de Catelan, a zealous Cartesian, who declared in his *Logistique Universelle, et Méthode pour les Tangentes* (1694), that it would be better to

extend the principles of the Cartesian geometry than to seek for new methods; and this was said in the preface of a book composed on the principles, somewhat disguised, of the very calculus of which he was an opponent. It had another adversary in Nieuwentijt, a man who had written some tolerable works on morality and religion, but who had slight pretensions to be regarded as a geometer. Catelan was satisfactorily answered by De l'Hôpital, as was Nieuwentijt by Leibnitz, and afterward by Bernoulli and Hermann, who proved that this adversary of the calculus really did not know what he opposed. For instance, Nieuwentijt, while admitting differentials of the first order, rejected all those of higher orders. For such a difference of treatment there is no foundation, for, if we imagine in a circle an infinitely small chord of the first order, the versine is an infinitely small line of the second order.

The calculus had a more formidable enemy in Rolle, a skillful algebraist, but a man full of confidence in his own notions, rash in forming his opinions, and jealous of the inventions of others.

Mathematicians have differed as to the best way of expounding the principles of the calculus. Newton employed the theory of motion as the means of connecting its doctrines with the principles of ordinary analysis. Leibnitz, again, with the same view, conceived quantity as passing from one degree of magnitude to another by the continual addition of infinitely small parts. The mind finds no great difficulty in distinctly apprehending the subject in either way. Objections have, however, been taken to both, and attempts made to substitute a better. Euler considered the infinitely small quantities of Leibnitz as absolutely zeros, that have to each other ratios derived from those of the vanishing quantities which they replace. D'Alembert proposed to make the basis of the calculus the consideration of the ratios of the limits of quantities. This method, as was indeed stated by D'Alembert, does not differ in any material respect from Newton's prime and ultimate ratios. An English mathematician, Landen, substituted for the Newtonian method of fluxions another purely algebraical. His views are contained in a work entitled *The Residual Analysis, a new branch of the Algebraic Art* (1764). Lagrange, too, in the *Memoirs of the Berlin Academy* for 1772, proposed to base the calculus altogether on the expansion of functions, and thus to establish it on algebraical principles merely. He subsequently developed his method in his *Théorie des Fonctions Analytiques* (1797), and in his *Leçons sur le Calcul des Fonctions* (1806). Lagrange, however, adopted the infinitesimal method as the basis of his most important work, viz., the *Mécanique Analytique*. He states in his preface to its second edition (1811) that "when we have properly conceived the spirit of the infinitesimal method, and are convinced of the exactness of its results by the geometrical method of prime and ultimate ratios, or by the analytical method of derived functions, we may employ infinitely small quantities as a sure and valuable means of abridging and simplifying our demonstrations."

INFLUENZA (generally known as La Grippe) is a term applied to an infectious febrile disorder of short duration, characterized specially by catarrh of the respiratory passages and alimentary canal, and occurring mostly as an epidemic.

The symptoms of this disease develop suddenly, with all the phenomena attending a severe cold or catarrh. At first there are chills or rigors, which are soon accompanied with distressing headache and tightness across the forehead, tenderness and watering of the eyes, and sneezing and discharge from the nostrils. To these succeed heat and soreness of the throat, hoarseness, cough,

and, it may be, some difficulty of breathing. The temperature is elevated, the pulse quick and feeble, and the skin, which at first was dry, becomes moist, and is said to exhale a peculiar musty odor. The digestive system participates in the disturbance, and there is loss of appetite, with thirst, vomiting, and occasionally diarrhœa.

Rapid loss of strength and remarkable depression of spirits accompany these various symptoms, and are among the most characteristic features of the disease. After lasting for two or three days, the symptoms abate and convalescence begins, but there may remain, particularly in severe cases, and in persons at the extremes of life, great debility for a length of time, or the attack may be complicated with inflammatory affections of the chest, which may prove a source of danger far exceeding that of the original disease. Apart from this, influenza is not usually a very fatal malady, although some epidemics such as those of 1762 and 1889 have been characterized by a severe type of the disease and considerable loss of life. The mortality is generally reckoned at about 2 per cent., but when an extensive epidemic prevails, even this proportion is sufficient to swell the death-rate largely.

This disease is referred to in the works of the ancient physicians, but accurate descriptions of it have been given by numerous medical writers during the last three centuries, in connection with epidemics which have occurred from time to time. These various accounts agree substantially in their narration of the phenomena and course of the disease, and influenza has in all times been regarded as fulfilling all the conditions of an epidemic in its sudden invasion, rapid and extensive spread, and speedy and complete disappearance. Among the chief epidemics of influenza are those of 1762, 1782, 1787, 1803, 1833, 1837, 1847, and 1889. In several of these the disease appeared to originate in some parts of Asia, and to travel westward through Europe and on to America, resembling in this respect certain cholera epidemics, although the two classes of disease have nothing in common. In some of the epidemics influenza has spread through the whole of Europe in the course of six weeks. Wherever it appears the whole community suffers to a greater or less extent, irrespective of age or condition of life. It has occasionally appeared in fleets at sea away from all communication with land, and to such an extent as to disable them temporarily for service. This happened in 1782 in the case of the squadron of Admiral Kempenfelt, which had to return to England from the coast of France in consequence of a severe epidemic of influenza attacking his crews, while at the same time the squadron of Lord Anson, off the coast of Holland, suffered extensively from a similar outbreak. Many instances of a like kind have been recorded.

Much speculation and some amount of scientific inquiry have been expended in endeavors to ascertain the cause of this remarkable ailment. The Italians in the seventeenth century ascribed it to the influence of the stars, and hence the name "influenza," by which the disease has subsequently been known. By some it has been held to depend on certain telluric, and by others on certain climatic conditions; but the occurrence of the disease in all sorts of climates and localities is sufficient to negative these theories. The view which refers it to some morbid principle present in the atmosphere during an epidemic is that which has gained widest acceptance, but the nature of this infecting agent is unknown. Various hypotheses have been advanced on the subject, such as some change in the electrical condition of the air, or the over-abundance of ozone, but these have not been confirmed by observation. More probable, and more in harmony with observed facts, is the theory that

in influenza, as in other epidemic diseases, there is present in the atmosphere some minute organism of specific nature, which is not only distributed over wide areas, but which when introduced into the bodies of those attacked multiplies there indefinitely, and becomes a source of infection by the breath, etc., and in this way a further cause of the spread of the disease. The contagiousness of influenza appears to be unquestionable. The treatment of this disorder is at present very diverse in principle and practice. That yielding best results during the last epidemic seemed to be exhibited in those cases in which special attention was directed to allaying tendency to congestion in the earlier stages of the disease, accompanied by a free administration of alkaline and anodyne remedies such as salycillate of sodium, codeine, etc., and in the latter stages of the disease the employment of tonics and antiperiodics, such as arsenious acid, iron, quinine, etc. Due attention should be paid to the catarrhal and (when present) digestive disturbances. The constitutional treatment as above suggested must be supplemented by judicious applications of local treatment to induce warmth, perspiration, etc., but care must be taken not to encroach on the strength of the patient, and if possible the occurrence of complications such as pneumonia, bronchitis, etc., avoided.

INFORMATION, in law, is a formal accusation of a crime committed, preferred *ex officio* by the commonwealth's attorney or other law officer without the intervention of a grand jury. It lies only for misdemeanor and not for treason, felonies, or misprision of treason; and it is properly employed against such "enormous misdemeanors" as peculiarly tend to disturb or endanger the government, *e.g.*, seditions, obstructing officers in the execution of their duties, etc. The information is filed without the leave of the court. An information may also be filed at the instance of a private prosecutor for misdemeanors not affecting the government, but being peculiarly flagrant and pernicious. Thus criminal informations have been granted for bribing or attempting to bribe public functionaries, and for aggravated libels on public or private persons. Leave to file an information is obtained after an application to show cause, founded on a sworn statement of the material facts of the case.

INFUSORIA. See **PROTOZOA**.

INGELHEIM. Oberingelheim and Niederingelheim, two contiguous market-towns of Germany, in the Hessian province of Rhine Hesse, circle of Bingen, are situated on the Hessian Ludwig Railway and on the Salz near its confluence with the Rhine, nine miles west-northwest of Mainz.

INGEMANN, BERNHARD SEVERIN (1789-1862), a Danish poet and novelist, was born at Torkildstrup, in the island of Falster.

INGERSOLL, a town of Oxford county, Ontario, Canada, with a population (1890) of 5,500. It has banks, newspaper offices, foundries, machinery, woolen and wooden-ware factories and good railroad and telegraph facilities.

INGOLSTADT, a fortified town in the government district of Upper Bavaria, is situated on the left bank of the Danube at its junction with the Schutter, fifty miles north of Munich by rail. As the chief town of the district it is the seat of the usual authorities. The town is well built. The principal buildings are the old castle of the dukes of Bavaria-Ingolstadt, now used as an arsenal; the remains of the earliest Jesuits' college in Germany, founded in 1555; the former university buildings, now a school; the theater; the large Gothic church of Our Lady, founded in 1425, with two massive towers, and the grave of Doctor Eck, Luther's opponent; the Franciscan convent and nunnery; and

several other churches and hospitals. Population about 16,000.

INGRES, JEAN AUGUSTE DOMINIQUE, whose name represents one of the most important among the conflicting tendencies of modern art, was born at Montauban, France, August 29, 1780. At Toulouse, to which place his father had removed from Montauban in 1792, Ingres received lessons from Joseph Roques, a painter, whom he quitted at the end of a few months to become a pupil of M. Vigan, professor at the academy of fine arts in the same town. From M. Vigan, Ingres, whose vocation became day by day more distinctly evident, passed to M. Briant, a landscape-painter, who insisted that his pupil was specially gifted by nature to follow the same line as himself. For a while Ingres obeyed, but he had been thoroughly aroused and enlightened as to his own objects and desires by the sight of a copy of Raphael's *Madonna della Sedia*, and having decisively ended his connection with Briant, he started for Paris, where he arrived about the close of 1796. He was then admitted to the studio of David, for whose lofty standard and severe principles he always retained a profound appreciation. David recognized the merit of one who soon ranked among his most promising pupils, and Ingres, after four years of devoted study, in the course of which (1800) he obtained the second place in the yearly competition, finally carried off the Grand Prix (1801). The work thus rewarded—the *Ambassadors of Agamemnon in the Tent of Achilles* (École des Beaux Arts)—was admired by Flaxman so much as to give umbrage to David, and was succeeded in the following year (1802) by the execution of a *Girl after Bathing*, and a woman's portrait; in 1804 Ingres exhibited *Portrait of the First Consul* (Musée de Liège), and portraits of his father and himself; these were followed in 1806 by *Portrait of the Emperor* (Invalides), and portraits of M., Mme., and Mlle. Rivière (the first two now in the Louvre). All these and various minor works were executed in Paris, for it was not until 1809 that the state of public affairs admitted of the reestablishment of the Academy of France at Rome, and we find from the journals of the day that they produced a disturbing impression on the public. It was clear that the artist was someone who must be counted with; his talent, the purity of his line, and his power of literal rendering were generally acknowledged; but he was reproached with a desire to be singular and extraordinary.

The year after his arrival in Rome (1808) Ingres produced *Edipus and the Sphinx*, a work which proved him in the full possession of his mature powers, and began the *Venus Anadyomene*, completed forty years later, and exhibited in 1855. These works were followed by some of his best portraits, that of M. Bochet (Louvre), and that of Mme. la Comtesse de Tournon, mother of the prefect of the department of the Tiber; in 1811 he finished *Jupiter and Thetis*, an immense canvas now in the Musée of Aix; in 1812 *Romulus and Acron*, and *Virgil reading the Æneid*—a composition very different from the version of it which has become widely popular through the engraving executed by Pradier in 1832. The original work, executed for a bed-chamber in the Villa Aldobrandini-Miollis, contained neither the figures of Mæcenæ and Agrippa nor the statue of Marcellus; and Ingres, who had obtained possession of it during his second stay in Rome, intended to complete it with the additions made for engraving. But he never got beyond the stage of preparation, and the picture left by him, together with various other studies and sketches, to the Musée of his native town, remains half destroyed by the process meant for its regeneration. The *Virgil* was followed by the *Betrothal of Raphael*, a small painting, now lost, executed for

Queen Caroline of Naples; *Don Pedro of Toledo Kissing the Sword of Henry IV.*, exhibited at the Salon of 1814, together with the *Chapelle Sistine* (Collection Legentil; lithographed by Sudre), and the *Grande Odalisque* (Collection Seillière; lithographed by Sudre). In 1815 Ingres executed *Raphael* and the *Fornarina* (Collection Mme. N. de Rothschild; engraved by Pradier); in 1816 *Aretin and the Envoy of Charles V.* (Collection Schroth), and *Aretin and Tintoret* (Collection Schroth); in 1817 the *Death of Leonardo* (engraved by Richomme) and *Henry IV. Playing with his Children* (engraved by Richomme), both of which works were commissions from M. le Comte de Blacas, then ambassador of France at the Vatican. *Roger and Angelique* (Louvre; lithographed by Sudre), and *Francesca da Rimini* (Musée of Angers; lithographed by Aubry Leconte), were completed in 1819, and followed in 1820 by *Christ giving the Keys to Peter* (Louvre).

During all these years Ingres' reputation in France did not increase. The interest which his *Chapelle Sistine* had aroused at the Salon of 1814 soon died away; not only was the public indifferent, but among his brother artists Ingres found scant recognition. The strict classicists looked upon him as a renegade, and strangely enough Delacroix and other pupils of Guérin—the very leaders of that romantic movement for which Ingres, throughout his long life, always expressed the deepest abhorrence—alone seem to have been sensible of his merits. The weight of poverty, too, was hard to bear. The good offices of Bartolini, and of one or two persons who felt a friendly interest in the painter, could only alleviate the miseries of this stay in a town where Ingres was all but wholly deprived of the means of at least gaining daily bread by the making of those small portraits for the execution of which, in Rome, his pencil had been constantly in request. Before his departure he had, however, been commissioned to paint for M. de Pastoret the *Entry of Charles V. into Paris*, and M. de Pastoret now obtained an order for Ingres from the Administration of Fine Arts; he was directed to treat the *Vœu de Louis XIII.* for the cathedral of Montauban. This work, which was exhibited at the Salon of 1824, met with universal approbation; even those sworn to observe the unadulterated precepts of David found only admiration for the *Vœu de Louis XIII.* On his return Ingres was received at Montauban with enthusiastic homage, and found himself celebrated throughout France. In the following year (1825) he was elected to the Institute, and his fame was further extended in 1826 by the publication of Sudre's lithograph of the *Grand Odalisque*, which, having been scorned by artists and critics alike in 1819, now became widely popular. A second commission from the government called forth the *Apotheosis of Homer*, which, replaced by a copy in the decoration of the ceiling for which it was designed, now hangs in the galleries of the second story of the Louvre. From this date up till 1834 the studio of Ingres was thronged, as once had been thronged the studio of David, and he was a recognized *chef d'école*. While he taught with despotic authority, and admirable wisdom, he steadily worked; and when in 1834 he produced his great canvas of the *Martyrdom of Saint Symphorien* (cathedral of Autun; lithographed by Trichot-Garneri), it was with angry disgust and resentment that he found his work received with the same doubt and indifference, if not the same hostility, as had met his earlier ventures. The suffrages of his pupils, and of one or two men—like Decamps—of undoubted ability, could not soften the sense of injury. Ingres resolved to work no longer for the public, and gladly availed himself of the opportunity to return to Rome,

as director of the École de France, in the room of Horace Vernet. There he executed *La Vierge à l'Hostie* (Imperial collections St. Petersburg), *Stratonice* (Duc d'Aumale), *Portrait of Cherubini* (Louvre), and the *Petite Odalisque* for M. Marcotte, the faithful admirer for whom, in 1814, Ingres had painted the *Chapelle Sistine*.

The *Stratonice*, executed for the duke of Orleans, had been exhibited at the Palais Royal for several days after its arrival in France, and the beauty of the composition produced so favorable an impression that, on his return to Paris in 1841, Ingres found himself received with all the deference that he felt to be his due. A minor work, *Jupiter and Antiope*, marks the year 1851, but Ingres' next considerable undertaking (1853) was the *Apotheosis of Napoleon I.*, painted for the ceiling of a hall in the Hôtel de Ville; *Jeanne d'Arc* (Louvre) appeared in 1854; and in 1855 Ingres consented to rescind the resolution more or less strictly kept since 1834, in favor of the International Exhibition, where a room was wholly reserved for his works. In consequence of the effect which they produced, Prince Napoleon, president of the jury, proposed an exceptional recompense for their author, and obtained from the emperor Ingres' nomination as grand officer of the Legion of Honor. With renewed confidence Ingres now took up and completed one of his most charming productions—*La Source* (Louvre), a figure of which he had painted the torso in 1823, and which seen with other works in London (1862) there renewed the general sentiment of admiration, and procured him, from the imperial government, the dignity of senator. After the completion of *La Source*, the principal works produced by Ingres were, with one or two exceptions, of a religious character; *La Vierge de l'Adoption*, 1858 (painted for Mdlle. Roland-Gosselin), was followed by *La Vierge Couronnée* (painted for Mme. la Baronne de Larinthe) and *La Vierge aux Enfants* (Collection Blanc); in 1859 these were followed by repetitions of *La Vierge à l'Hostie*; and in 1862 Ingres completed *Christ and the Doctors* (Musée Montauban), a work commissioned many years before by Queen Marie Amélie for the chapel of Bizy. On January 14, 1867, Ingres died, in his eighty-eighth year, having preserved his faculties in wonderful perfection to the last.

INGULPHUS [INGULF], abbot of Crowland, for a long period believed to be the author of the *Historia Monasterii Croylandensis*, was born of English parents. The account of him given at the conclusion of the *Historia* has been shown to be incorrect in several particulars, but according to the authority of Ordericus Vitalis, who visited Crowland three years after the death of Ingulf, he became secretary to William, duke of Normandy, and after taking part in a pilgrimage to Jerusalem, lived as a monk in Normandy, where he rose to the rank of prior. After the accession of William to the throne of England, he in 1085 received the abbatial stall of Crowland, Lincolnshire, where he remained till his death, December 16, 1109.

INHERITANCE. In English law, inheritance, heir, and other kindred words have a meaning very different from that of the Latin *hæres*, from which they are derived. In Roman law the heir or heirs represented the entire legal personality of the deceased—his *universum jus*. In English law the heir is simply the person on whom the real property of the deceased devolves by operation of law if he dies intestate. He has nothing to do as heir with the personal property; he is not appointed by will; and except in the case of coparceners he is a single individual. The Roman *hæres* takes the whole estate; his appointment may or may not be by testament; and more persons than one may be associated together as heirs.

In the United States the English law of inheritance has been more completely repudiated than any other portion of the British system. Each State has established rules of descent for itself, and the observation of Chief Justice Reeve that the nation "has no general law of descents, which probably has not fallen to the lot of any other country," is to some extent justified by the great differences in detail between the rules obtaining in the different States. The following are the rules of most general application, as stated in Kent's *Commentaries on American Law*, twelfth edition, edited by O. W. Holmes, Jr. 1. Real estate shall descend to the lawful descendants of the owner, in the direct line of lineal descent; and if there be but one person, then to him or her alone; and if more than one person, and all of equal degrees of consanguinity to the ancestor, then to the several persons or tenants in common in equal parts, however remote from the intestate the common degrees of consanguinity may be. 2. When the lawful issue are of unequal degrees of consanguinity to the intestate, the inheritance shall descend to the children and grandchildren, if any be living, and to the issue of such as shall be dead, as tenants in common; but such grandchildren and their descendants inherit only such shares as their parents respectively would have taken if living. These two rules are stated to prevail in all the United States, with some important variations, however, in the case of the first rule. 3. In the absence of descendants the inheritance goes to the parents, either first to the father and next to the mother, or jointly under certain conditions. 4. If the intestate dies without issue or parents the estate goes to his brothers and sisters and their representatives. If the relatives are of equal degrees of consanguinity they take in equal parts; but if, of the same degree, some be dead, leaving issue, and others living, the descendants of those who are dead take only their parents' share. Collaterals under this rule would be preferred to ascendants—after parents. "It is, perhaps, universally the rule that brothers and sisters are preferred to grandparents, though the latter stand in an equal degree of kindred." In some States there is no essential distinction left between the whole and the half-blood, in others the half-blood is postponed, but nowhere is it totally excluded. 5. In default of the foregoing, the inheritance generally goes to grandparents, but in some states (New York, New Jersey, and North Carolina) grandparents are excluded, and in others postponed. 6. Next come uncles and aunts and their descendants, taking *per capita* if of equal degree, and *per stirpes* if not. 7. If the inheritance came to the deceased on the part of his father, the father's brothers and sisters would exclude the mother's brothers and sisters, and the mother's brothers and sisters would have a similar preference in respect of property coming to the deceased *ex parte materna*. A similar distinction is observed in some States in applying the fourth rule. 8. On failure of heirs under the preceding rules, recourse is had to the "next-of-kin" as ascertained by the English statute of distributions. In many of the States the harshness of the English rule that natural children have no inheritable blood is greatly mitigated. In Louisiana, if duly acknowledged, they may inherit from both father and mother in the absence of lawful issue.

INJUNCTION, in law, is a judicial process whereby a party is required to refrain from doing a particular thing according to the exigency of the writ. From this definition it is apparent that an injunction is properly a restraining order, although there are instances in which, under the form of a prohibition, a positive order to do something is virtually expressed. Thus in a case of nuisance an injunction was obtained to restrain the de-

fendant from preventing water from flowing in such regular quantities as it had ordinarily done before the day on which the nuisance commenced. But generally, if the relief prayed for is to compel something to be done, it cannot be obtained by injunction, although it may be expressed in the form of a prohibition—as in the case in which it was sought to prevent a person from discontinuing to keep a house as an inn, which is the same thing as ordering to keep an inn. The injunction was used to stay proceedings in other courts "wherever a party by fraud, accident, mistake, or otherwise had obtained an advantage in proceeding in a court of ordinary jurisdiction, which must necessarily make that court an instrument of injustice."

INK (French, *encre*; German, *tinte*), in its widest signification, is the medium employed for producing graphic tracings, inscriptions, or impressions on paper or similar materials. The term includes two distinct conditions of pigment or coloring matter:—the one fluid, and prepared for use with a pen or brush, as writing ink; the other a glutinous, adhesive mass, printing ink, used for transferring to paper impressions from types, engraved plates, and other like surfaces. The latter class may be more properly dealt with under LITHOGRAPHY and PRINTING, (*q.v.*)

Writing inks are fluid substances which contain coloring matter either in solution or in suspension, and very commonly partly in both conditions. They may be prepared in all shades of color, and contain in their composition almost every pigment which can be dissolved or suspended in a suitable medium; but by far the most important of all varieties is black ink, after which red and blue are the colors most commonly employed. Other colors are only occasionally employed; but apart from color there are special qualities which recommend certain inks for limited applications, such as marking inks, ineradicable inks, sympathetic inks, etc.

Among the qualities which should characterize a good black ink for ordinary purposes, the following are important:—It should continue limpid, and flow freely and uniformly from the pen; it should not throw down a thick sludgy deposit on exposure to the air; nor should a coating of mold form on its surface. It should yield distinctly legible characters immediately on writing, which ought to become a deep blue-black, not fading or decaying with age; and the fluid ought to penetrate into the paper without spreading, so that the characters will neither wash out nor be readily removed by erasure. Further, it is desirable that ink should be non-poisonous, that it should as little as possible corrode steel pens, that characters traced in it should dry readily on the application of blotting paper without smearing, and that the writing should not present a glossy varnished appearance. To obtain these characteristics is the chief object of the ink manufacturer; and upon the whole they have hitherto been found best combined in ink prepared from galls, or other sources of tannin, and a salt of iron, with the addition of some coloring matter. Such a compound indeed forms the staple black ink of commerce, which is essentially a ferroso-ferric gallate in extremely fine division held in suspension in water.

The essential ingredients of this ordinary black ink are—first, tannin-yielding bodies, for which Aleppo or Chinese galls are the only eligible materials; second, a salt of iron, the ferrous sulphate (green vitriol) being alone employed; and third, a gummy or mucilaginous agent to keep in suspension the insoluble tinctoral matter of the ink.

Ink which yields by means of pressure an impression, on a sheet of damped tissue paper, of characters written in it is called copying ink. Any ink soluble in water, or which retains a certain degree of solubility, may be

used as copying ink. The pigment most commonly employed as the basis of red ink is Brazil-wood, a dyestuff which yields a good, durable ink. For the production of blue ink, the pigment principally used is Prussian blue. China ink or Indian ink is the form in which ink was earliest prepared, and in which it is still made and used in China and Japan for writing with small brushes instead of pens. It is extensively used by architects, engineers, and artists generally, and for various special uses. China ink is prepared in the form of sticks and cakes, which are rubbed down in water for use. It consists essentially of lampblack in very fine condition, baked up with a glutinous substance, and the finer Oriental kinds are delicately perfumed. Marking ink, so called, used principally for marking linen, is composed of a salt of silver, usually the nitrate, dissolved in water and ammonia, with a little provisional coloring matter and gum for thickening. The color resulting from the silver salt is developed by heat and light, and the stain it makes, although exceedingly obstinate, gradually becomes a faint brownish-yellow. Gold and silver inks are writing fluids in which gold and silver, or imitations of these metals, are suspended in a state of fine division. In place of gold, Dutch leaf or mosaic gold is frequently substituted, and bronze powders are also used for preparing a similar kind of ink. Indelible or incorrodible ink is the name given to various combinations of lamp-black or other carbonaceous material with resinous substances used for writing which is exposed to the weather or to the actions of strong acids or alkaline solutions.

Sympathetic inks are preparations used for forming characters which only become visible on the application of heat or of some chemical reagent. Many chemicals which form in themselves colorless solutions, but which develop color under the influence of reagents, may be used as sympathetic ink, but they are all of little practical utility.

INLAYING is a method of ornamentation, by incrusting or otherwise inserting in one material a substance or substances differing therefrom in color or nature. The art is practiced in the fabrication of furniture and artistic objects in all varieties of wood, metal, shell, ivory, and colored and hard stone, and in compound substances; and the possible combinations, styles, and varieties of effect are exceedingly numerous. There are several special classes of inlaying, long established and well-recognized details regarding most of which will be found under their separate headings. In the ornamental treatment of metal surfaces *Niello* decoration, applied to silver and gold, is an ancient and much practiced species of inlaying. An art, analogous in effect, called *Bidri*, from Bider in the Deccan, is practiced in India. The inlaying of gold wire in iron or steel is known as damaskeening. In Kashmir, vessels of copper and brass are very effectively inlaid with tin—an art which, like many other decorative arts, appears to have originated in Persia. In the ornamental inlaying of metal surfaces the Japanese display the most extraordinary skill and perfection of workmanship. In the inlaying of their fine bronzes they use principally gold and silver, but for large articles and also for common cast hollow ware (for with them inlaying is common and profuse) commoner metals and alloys are employed. In inlaying bronzes they generally hollow out and somewhat undercut the design, into which the ornamenting metal, usually in the form of wire, is laid and hammered over so as to be firmly inserted. Frequently the famous lacquer-work of the Japanese is inlaid with mother-of-pearl and other substances, in the same manner as is practiced in ornamenting lacquered papier-mache among Western communities. The Japanese also practice the various methods of inlaying

alluded to under damaskeening. The term *Mosaic* (see MOSAIC) is generally applied to inlaid work in hard stones, marble, and glass, but the most important class of mosaics—those which consist of innumerable small separate pieces—do not properly come under the head of inlaying. *Pietra Dura* is a fine variety of inlaid mosaic in which hard and expensive stones—agate, carnelian, amethyst, and the like—are used in relief in marble. Under the head BUHL WORK (*q. v.*) will be found a description of the kind of inlaying, principally brass and tortoiseshell, which was introduced and carried to great perfection by André Charles Boule, who gave his name to this particular style of inlaying. Closely allied to buhl work is the more ancient *Tarsia* work or *Marquetry*, which consists of inlaid woods alone. It has been practiced from remote times, but came into prominence, for the decoration of furniture, in Italy during the Renaissance epoch, and has continued to be a favorite decorative art, varying with changing tastes and styles, to the present day. From India, under the name of Bombay boxes, comes a variety of minute and elaborate work, inlaid in geometrical patterns on wood. The inlaying materials consist of tin wire, sandal wood, sapan wood, ebony, ivory, and stag's horns, and the effect produced by the combination of minute pieces of these various substances is altogether peculiar and distinctive. Certain kinds of ENAMEL (*q. v.*) might also be included among the varieties of inlaying.

INNKEEPERS, LAW RELATING TO. By the common law the United States innkeepers are under certain peculiar obligations, the most important of which are the duty of supplying accommodation to such travelers as may desire it, and their responsibility for the safety of the goods belonging to persons staying in their inns. An inn is a place "instituted for passengers and wayfarers," and in a recent case, in which the proprietor of a restaurant was prosecuted for refusing refreshment on demand, it was held that a tavern, or shop for the retail of spirits across the counter, is not within the definition, and that a person resident in the neighborhood of the inn is not a traveler. An innkeeper may be indicted for refusing accommodation to a traveler, who may also of course have a remedy by civil action. In some American cases it has been held that the possession of a license does not produce, nor does the absence of a license prevent, the liabilities of an innkeeper at common law. An inn is distinguished from a boarding-house in this, that in the latter the guest is under an express contract for a certain time at a certain rate, in the former under an implied contract from day to day. Even if a boarding-house keeper entertains guests in the capacity of an innkeeper, he is not liable as such to his boarding-house guests.

INNOCENT I., pope from 402 to 417, was, according to his biographer in the *Liber Pontificalis*, the son of a man called Innocent of Albano; but, according to the more trustworthy Jerome, his father was Pope Anastasius I., whom he was called by the unanimous voice of the clergy and laity to succeed. It was during his papacy that the siege of Rome by Alaric (408) took place, when, according to a doubtful anecdote of Zosimus, the ravages of plague and famine were so frightful, and divine help seemed so far off, that papal permission was granted to sacrifice and pray to the heathen deities; the pope happened, however, to be absent from the city on a mission to Honorius at Ravenna at the time of the sack in 410. He lost no opportunity of maintaining and extending the authority of the Roman see as the ultimate resort for the settlement of all disputes; and his still extant communications to Victricius of Rouen, Exuperius of Toulouse, Alexander of Antioch, and

others, as well as his action on the appeal made to him by Chrysostom against Theophilus of Alexandria, show that opportunities of the kind were numerous and varied. He took a decided view on the Pelagian controversy, confirming the decisions of the synod of the province of proconsular Africa held in Carthage in 416, which had been sent to him, and also writing in the same year in a similar sense to the fathers of the Numidian synod of Mileve who, Augustine being one of their number, had addressed him. Among his letters are one to Jerome and another to John, bishop of Jerusalem, regarding annoyances to which the first-named had been subjected by the Pelagians at Bethlehem. He died March 12, 417, and in the Romish Church is commemorated as a confessor along with Saints Nazarius, Celsus and Victor, martyrs, on July 28th. His successor was Zosimus.

INNOCENT II., pope from 1130 to 1143, whose family name was Paparesci, his own baptismal name being Gregory, was probably one of the clergy in personal attendance on the antipope Clement III. (Guibert of Ravenna). By Paschal II. he was created cardinal-deacon. In this capacity he accompanied Pope Gelasius II. when driven into France; and by Calixtus II. he was employed on various important missions, such as on that to Worms for concluding the peace concordat with the emperor in 1122, and on that to France in 1123. On February 14, 1130, he was hurriedly chosen to succeed Honorius II.; soon afterward an opposition asserted itself which issued in the counter-election of Pietro Pierleoni as Pope Anacletus II. Unable to maintain his position in Rome, Innocent took ship for Pisa, and thence sailed by Genoa to France, where the influence of Bernard of Clairvaux readily secured his cordial recognition by the clergy and the court; in October of the same year he was duly acknowledged by Lothaire of Germany and his bishops at the synod of Würzburg. In January, 1131, he had also a favorable interview with Henry II. of England; and in August, 1132, Lothaire undertook an expedition to Italy for the double purpose of being crowned by the pope and of setting aside the antipope. The coronation ultimately took place in the Lateran church (June 4, 1133), but otherwise the expedition proved abortive. A second expedition by Lothaire in 1136 was not more decisive in its results, and the protracted struggle between the rival pontiffs was terminated only by the death of Anacletus on January 25, 1138. By the Lateran council of 1139, at which Roger of Sicily, Innocent's most uncompromising foe, was excommunicated, peace was at last restored to the church. Innocent died September 23, 1143, and was succeeded by Celestine II. The doctrinal questions in which he was called on to interfere were those connected with the names of Abelard and Arnold of Brescia.

INNOCENT III., pope from 1198 to 1216, by far the most remarkable of the popes who have reigned under this name, and, if Gregory VII. is excepted, perhaps the greatest of all who have occupied the see of St. Peter, was born at Anagni about 1160. His father, Count Trasimundo of Segni, was a member of the famous house of Conti, from which nine popes, including Gregory IX., Alexander IV., and Innocent XIII., have sprung; his mother, Claricia, belonged to the noble Roman family of Scotti. His own baptismal name was Lothario. After receiving the rudiments of his education in Rome, he studied theology under Peter of Corbeil at Paris, and canon law at Bologna. On his return to Rome in 1181 he became a canon of St. Peter's; and through family influence, combined with the increasing evidence he gave of remarkable ability, his subsequent promotion was rapid. By Gregory VIII. he was appointed one of the subdeacons, and in 1190

(when barely thirty) he was, at the instance of his maternal uncle Clement III., made cardinal-deacon of St. Sergius and St. Bacchus. On the death of Clement (1191), who was succeeded by Celestine III., a member of the rival house of Orsini, Cardinal Lothario was but little employed in church affairs; the unsought leisure which he now possessed he devoted to the composition of three works, two of which have come down to our times. On the death of Celestine III. (January 8, 1198), Lothario was without a day's delay unanimously chosen to succeed him; his ordination to the priesthood (hitherto he had held only deacon's orders), his episcopal consecration, and his coronation as pope (February 22, 1198), followed one another in rapid succession. The state of Europe and of the known world at that juncture was such as might have suggested even to a less able and energetic man than Innocent the ambition of once more seeking to obtain for the papacy that absolute supremacy, both spiritual and temporal, in the struggle for which his great predecessor Gregory, more than a century before him, had lost his throne, and, one might almost say, his life. The owner of the crown of Naples (Frederick II., born 1197) was an infant, incapable of protecting his dominions from the numerous adventurers by whom they were overrun; the Lombard republics were at deadly feud with one another, or rent by increasing domestic faction; the empire was convulsed by the struggles of the rival claimants to the throne rendered vacant by the death of Henry VI.; in France Philip Augustus since 1180 had been disgusting his subjects with his tyranny and scandalous vice; at Constantinople the cruel and wicked Alexius III., after dethroning his elder brother Isaac Angelus, was struggling to maintain his precarious grasp of the scepter, while the kingdom of Jerusalem, which half a century before had extended along nearly the whole coast of Syria, was now almost entirely confined to the city of Acre. Innocent's first care was to deliver Rome itself from the claims to supreme authority asserted by the prefect, who for many years had been nominated by the emperor, but whom now he compelled to swear allegiance to himself, thus for the first time practically establishing the temporal sovereignty of the bishop of Rome over his own city. In another direction the popular rights in connection with the choice of a "senator" were curtailed. Measures were next taken to free the so-called patrimony of St. Peter from the various German adventurers who, professing to hold the empire, had divided it among them. Markwald of Anweiler, duke of Ravenna, was by a papal army driven from the March of Ancona, with which he had been invested, and compelled to withdraw to the south of Italy; Conrad of Lutzenberg, duke of Spoleto, was driven into Germany; Innocent personally visited Reate, Spoleto, Perugia, Todi, and everywhere was welcomed as sovereign and deliverer. His claim to the sovereignty of the duchy of Tuscany as heir of the countess Matilda, Hildebrand's friend, was successfully asserted next; and on the death of Constanti, widow of Henry VI. of Germany, Innocent, who had been acknowledged by her as liege lord, became, as guardian of the young Frederick II., master of the kingdom of Naples and Sicily. By the help of Walter of Brienne, Diephold of Acerra was compelled to relax his hold of Apulia; and in 1202 the death of Markwald at Palermo removed one of the most vigorous of the many troublers of Italian peace. The rivalry between Philip of Swabia, brother of Henry VI., and the Guelph Otto of Brunswick, for the imperial crown, in the next place offered a favorable opportunity for intervention in German politics after the more immediately pressing affairs of Rome and Italy had been settled. The tardy (but not reluctant) decision finally given

(March, 1201) by Innocent in favor of the Guelph did not indeed avert protracted civil war, resulting in humiliation and disaster both to emperor and pope; yet ultimately the murder of Philip (June 21, 1208) paved the way for the peaceful coronation of Otto in the following year, and the long-continued efforts of Innocent seemed to have met with an absolute success when the new emperor not only ratified previously exacted promises faithfully to maintain the territories, fiefs, and rights of the see of Rome as these had been defined by the see itself, but also renounced even the small share in episcopal elections which had been reserved to the empire in the concordat of Worms. The triumph, it is true, proved a hollow one; Otto soon broke his oath, claiming the kingdom of Apulia as a fief of the empire, and losing no time in commencing a war for the subjugation of Naples. Nor did his excommunication in 1211 result greatly to the advantage of the papacy, except in so far as it strikingly showed how dangerous to the individual was a collision with the supreme spiritual power. The battle of Bouvines (July 27, 1214) finally disposed of the last hopes of Otto, but by it there was left master of the field one who was destined to prove still more formidable in his opposition to ecclesiastical ascendancy. The immense influence which the energy, persistence, and political skill of Innocent enabled him to wield throughout the whole duration of his pontificate in the affairs of the empire was equally exemplified in his relations with almost every other state of Christendom. Thus one of his first acts after his accession was to signify his disapproval of the conduct of Philip Augustus of France in dismissing his lawful wife Ingeburga of Denmark. By a rigorous interdict laid upon the kingdom from December, 1199, to September, 1200, the headstrong and refractory king was at last compelled to take her back with all the honor due to the queen of France. So, when in England King John began to persecute the clergy in consequence of their adherence to the cause of Stephen Langton, the papal nominee to the archbishopric of Canterbury (1207), his own excommunication followed forthwith; the kingdom was laid under an interdict (March 24, 1208), his subjects released from their allegiance, and his throne offered to any conqueror, with effects which again were far from being such as Innocent had anticipated, but which could not fail to impress the minds of the men of that time with a new and deep sense of the vigor and far-reaching power of the vicars of Christ. In Castile, in Portugal, in Leon, in Navarre, in Denmark, Bohemia, Poland, Hungary, the same story repeats itself, with equal distinctness, if with less prominent results. Another outlet of the zeal and ambition of Innocent was found in the fifth crusade, the leading events of which, including the pact with Venice and the fall of Constantinople, have been elsewhere related. In the west also, a new crusade against heretics was set on foot with relentless energy, which has been described in the article *ALBIGENSES*. The principles upon which such enterprises ought to be conducted were formulated under the presidency of Innocent at the fourth Lateran council (1215). It was there decreed that all rulers should promise to tolerate no heretics within their dominions, and that any prince who should refuse to comply with an injunction of the church to purge his dominions of heresy was to be punished with excommunication, and in case of contumacy to be deposed, if necessary, by force of arms. To those who should take part in such application of armed force when declared necessary, immunities similar to those enjoyed by the Eastern crusaders were guaranteed. At the same time very stringent laws were made with reference to the Jews. **Their** disability to hold any public appointment of trust

was declared, and they were prohibited from at any time wearing Christian apparel, and also from appearing in public at all during Holy Week. This council was held by Innocent in the full consciousness of his approaching dissolution, which took place at Perugia on July 16, 1216. He was succeeded by Honorius III.

INNOCENT IV., Sinibaldo de Fieschi, pope from 1243 to 1254, belonged to one of the first families of Genoa, and, educated at Parma and Bologna, passed for one of the best canonists of his time. He had for his immediate predecessor Celestine IV., who, however, was pope for eighteen days only, and therefore the events of Innocent's pontificate practically link themselves onto those of the reign of Gregory IX. It was on occasion of Innocent's election (June 28, 1243) that Frederick II. is said to have remarked that he had lost the friendship of a cardinal and gained the enmity of a pope; the letter which he wrote, however, expressed in respectful terms the hope that an amicable settlement of the differences between the empire and the papal see might be reached. The negotiation which shortly afterward began with this object speedily proved abortive, Frederick being unable to make the absolute submission to the pope's demands which was required of him. Finding his position in Rome insecure, Innocent secretly withdrew in the summer of 1244 to Genoa, and thence to Lyons, where he summoned a general council which met in 1245 and deposed Frederick. The agitation caused by this act throughout Europe terminated only with Frederick's death in 1250, which permitted the pope to return, first to Perugia, and afterward in 1253 to Rome. The remainder of his life was largely devoted to schemes for compassing the overthrow of Manfred, the natural son of Frederick II., whom the towns and the nobility had for the most part received as his father's successor. It was on a sick bed at Naples that Innocent heard of Manfred's victory at Foggia, and the tidings are said to have precipitated his death (December 7, 1254). He was succeeded by Alexander IV.

INNOCENT V., pope from January 20 to June 22, 1276, was a native of Tarantasia in Burgundy, where he was born in 1225. His predecessor was Gregory X., and he was succeeded by Hadrian V.

INNOCENT VI., Stephen Aubert, pope, at Avignon, from 1352 to 1362, the successor of Clement VI., was a native of the diocese of Limoges, and, after having taught civil law at Toulouse, became bishop, successively, of Noyon and of Clermont. In 1342 he was raised to the dignity of cardinal. On the death of Clement VI., after the cardinals had each bound himself by a solemn agreement as to a particular line of policy should he be elected, Aubert was chosen (December 18, 1352); one of the first acts of his pontificate was to declare the paction to have been illegal and null. His subsequent policy compares favorably with that of the other Avignon popes. He brought about many needed reforms in the administration of church affairs, and, by his legate, Cardinal Albornoz, who was accompanied by Rienzi, he sought to restore order in Rome, where, in 1355, Charles IV. was, with his permission, crowned, after having previously come under an oath that he would quit the city on the day of the ceremony. It was largely through the exertions of Innocent that the peace of Bretigny (1360), between France and England, was brought about. During this pontificate, also, John Palæologus offered to submit the Greek Church to the Roman see, on condition of assistance being rendered him against John Cantacuzenus. The resources at the disposal of the pope, however, were all required for exigencies nearer home, and the offer was declined. Innocent was a liberal patron of letters, and, if the extreme severity of his measures against Fraticelli be kept out of account, had a deservedly

high reputation for justice and mercy. He died September 12, 1362, and his successor was Urban V.

INNOCENT VII., Cosimo de Migliorati, pope from 1404 to 1406, was a native of Solmona, in the Abruzzi, and early distinguished himself by his learning both in civil and in canon law. By Urban VI. he was called to the papal court, and intrusted with various responsible offices, being finally promoted to the archbishopric of Ravenna, and afterward to the bishopric of Bologna. Boniface IX. made him cardinal, and employed him as legate in several delicate and important missions. On the death of Boniface, Migliorati was unanimously chosen (October 17, 1404) to succeed him, after each of the cardinals had bound himself by a solemn obligation to employ all lawful means for the restoration of the church's unity in the event of his election, and even to resign the papal dignity should that be considered necessary to this end. The election was resisted at Rome by the Ghibelline party, but peace was maintained by the aid of Ladislaus, of Naples, who thus laid Innocent under embarrassing obligations, from which he freed himself at the earliest possible moment. The assassination of some leading members of the city party by Ludovico Migliorati (a nephew of Innocent) and his friends compelled the pope to take refuge, in August, 1405, at Viterbo, whence he did not return until January of the following year. These troubles furnished him with a pretext, of which he was not unwilling to avail himself, for postponing the meeting of a general council which was urged by Charles, of France; the university of Paris, Rupert, of Germany; and John, of Castile, as the only means of healing the schism which had prevailed so long. It is hardly necessary to say that he showed no favor to the proposal that he, as well as the antipope, Benedict XIII., should resign in the interest of peace. He died somewhat suddenly at Rome on November 6, 1406. There is no evidence of the truth of the allegation that his death was not due to natural causes. His successor was Gregory XII.

INNOCENT VIII., Giovanni Battista Cibo, pope from 1484 to 1492, was born at Genoa (1432), and was the son of a man of senatorial rank. His early years were spent at the Neapolitan court, and subsequently he went to Padua and Rome for his education. In the latter city the influence of his friends procured for him, from Paul II., the bishopric of Savona, and in 1473 he was made cardinal by Sixtus IV., whom he succeeded on August 29, 1484. Shortly after his coronation he addressed a fruitless summons to Christendom to unite in a crusade against the infidels; the amount of his own zeal may in some degree be estimated from the fact that in 1489, in consideration of a yearly sum of 40,000 ducats and a gift of the spearhead which had pierced the Savior's side, he consented to favor the sultan Bajazet II. by detaining his fugitive brother in close confinement in the Vatican. In 1486 Henry VII. of England was declared to be the lawful holder of the English crown by the threefold right of conquest, inheritance and popular choice. Innocent, in his bull "Summis desiderantes" (December 5, 1484), instigated very severe measures against magicians and witches in Germany; the principles enunciated by him were afterward embodied in the *Malleus maleficarum* (1487). He it was also who in 1487 appointed Torquemada to be grand inquisitor of Spain; he also urged a crusade against the Waldensians, offering plenary indulgence to all who should engage in it. In 1486 he prohibited, on pain of severe ecclesiastical censures, the reading of the nine hundred propositions of Pico Mirandola. An important event of his pontificate was the fall of Granada (January, 1492), which was celebrated in the Vatican with great rejoicings. He died July 25, 1493, leaving behind him numerous children

toward whom his nepotism had been as lavish as it was shameless. His successor was Alexander VI.

INNOCENT IX. succeeded Gregory XIV. on October 29, 1591, and died on December 30th of the same year. His pontificate was unimportant. Clement VIII. was his successor.

INNOCENT X., Giovanni Battista Pamphili, pope from 1644 to 1655, was born at Rome in 1574, attained the dignity of cardinal in 1629, and through French influence was chosen to succeed Urban VIII. on September 15, 1644. Throughout his reign the influence exercised over him by Olympia Maidalchina, his deceased brother's wife, was very great, and such as to give rise to gross scandal, for which, however, there appears to have been no adequate ground. He naturally enough objected to the conclusion of the peace of Westphalia, against which his nuncio in his name vainly protested, and against which he issued the bull "Zelo domus Dei" in November, 1648. The most important of his doctrinal decisions was his condemnation of the five Jansenist propositions in 1653. The avarice of his female counselor gave to his reign a tone of oppression and sordid greed which probably it would not otherwise have shown, for personally he was not without noble and reforming impulses. He died January 5, 1655, and was succeeded by Alexander VII.

INNOCENT XI., Benedetto Odescalchi, pope from 1676 to 1689, was born at Como in 1611, studied law at Rome and Naples, held successively the offices of protonotary, president of the apostolic chamber, commissary of the Marca di Roma, and governor of Macerata; in 1647 Innocent X. made him cardinal, and he afterward successively became legate to Ferrara and bishop of Novara. Two months after the death of Clement X. he was (September 21, 1676), in spite of French opposition, chosen his successor. He lost no time in declaring and practically manifesting his zeal as a reformer of manners and a corrector of administrative abuses. He sought to abolish sinecures, and to put the papal finances otherwise on a sound footing; beginning with the clergy, he sought to raise the laity also to a higher moral standard of living. Some of his regulations with the latter object, however, may raise a smile as showing more zeal than judgment. Personally not unfriendly to Molinos, he nevertheless so far yielded to the enormous pressure brought to bear upon him as to confirm, in 1687, the judgment of the inquisitors, by which sixty-eight Molinist propositions were condemned as blasphemous and heretical. His pontificate was marked by the prolonged struggle with Louis XIV. of France on the subject of the so-called "Gallican Liberties," and also about certain immunities claimed by ambassadors to the papal court. He died after a long period of feeble health on August 12, 1689, and was succeeded by Alexander VIII.

INNOCENT XII., Antonio Pignatelli, pope from 1691 to 1700, was the successor of Alexander VIII. He came of a distinguished Neapolitan family, and was born March 13, 1615. Educated at the Jesuit college in Rome, he in his twentieth year became an official of the court of Urban VIII.; under successive popes he served as nuncio at Florence and Vienna and in Poland; and by Innocent XI. he was made cardinal (1681) and archbishop of Naples. Immediately after his election (July 12, 1691), he declared against the nepotism which had long been one of the greatest scandals of the papacy; the bull "Romanum decet Pontificem," issued in 1692, prohibited popes in all time coming from bestowing estates, offices, or revenues on any relative; at the same time he sought to check the simoniacal practices of the apostolic chamber, and in connection with this to introduce a simpler and more economical manner of life into his

court. He introduced various much-needed reforms into the States of the Church, and for the better administration of justice erected the Forum Innocentianum. In 1693 he compelled the French bishops to retract the four propositions relating to the "Gallican Liberties" which had been formulated by the assembly of 1682. His pontificate contrasted with that of a series of predecessors in having marked leanings toward France instead of Germany. This benevolent, self-abnegating, and pious pope died on September 27, 1700, and was succeeded by Clement XI.

INNOCENT XIII., Michael Angelo Conti, pope from 1721 to 1724, was born in 1655, and became cardinal under Clement XI. in 1706. From 1697 to 1710 he acted as papal nuncio to the kingdom of Portugal, where he is believed to have formed those unfavorable impressions of the Jesuits which afterward influenced his conduct toward them. In 1721 his high reputation for ability, learning, purity, and a kindly disposition secured his election to succeed Clement XI. His pontificate was prosperous, but comparatively uneventful. He prohibited the Jesuits from prosecuting their mission in China, and ordered that no new members should be received into the order. This indication of his sympathies encouraged some French bishops to approach him with a petition for the recall of the bull "Unigenitus" by which Jansenism had been condemned; the request, however, was peremptorily denied. Innocent XIII., like his predecessor, showed much favor to the English Pretender, "James III.," and liberally supported him. He died March 7, 1724, and was succeeded by Benedict XIII.

INNSBRUCK, or INNSPRUCK (pop. 20,537), the chief town of the Tyrol, Austria, is situated on the right bank of the Inn, not far from its junction with the Sill, in a beautiful valley surrounded by lofty mountains, which seem to overhang the town. It is connected with its suburbs on the left bank of the stream by three bridges. The old wooden bridge, which was the scene of a fierce struggle between the Tyrolese and the Bavarians in 1809, was replaced in 1871-72 by a handsome iron structure, and the banks of the Inn have, during the last few years, been widened and planted with trees. Innsbruck is the seat of the law courts and the usual administrative offices for the district of Tyrol and Vorarlberg. The Franciscan or court church (1553-1563), in the Renaissance style, contains several works of art, of which the chief is the imposing cenotaph of the emperor Maximilian I. In the same church are the monuments of the patriots Hofer, Haspinger, and Speckbacher, and one in memory of the Tyrolese who fell in defense of their country between 1796 and 1809. The silver chapel of the church contains a silver Madonna and altarpiece, and the graves of Archduke Ferdinand II. and his wife Philippa. In this church Christina of Sweden, daughter of Gustavus Adolphus, publicly adopted the Roman Catholic faith in 1654. There are numerous monastic institutions, including a Jesuits' college, and a Capuchin convent, begun in 1593 as the first of the order in Germany. The university, founded in 1672, and, after being twice suspended, finally reconstituted in 1826, had in 1889-90 a teaching staff of seventy-six, and (1889-90) 700 students. It possesses a fine library. The Ferdinandeum, an interesting national museum, was founded in 1845, and is maintained by private enterprise. The manufactures of Innsbruck comprise woolen and cotton goods, stained glass, leather, and machinery; and there is considerable transit trade between Italy and Austria.

INNS OF COURT. The Inns of Court and Chancery are voluntary non-corporate legal societies seated in London, having their origin about the end of the

thirteenth and the commencement of the fourteenth century.

Dugdale (*Origines Juridicales*) states that the learned in the laws were anciently persons in holy orders, the justices of the king's court being bishops, abbots and the like. But in 1207 the clergy were prohibited by canon from acting in the temporal courts. The result proving prejudicial to the interests of the community, a commission of inquiry was issued by Edward I. (1290), and this was followed up (1292) by a second commission, which, among other things, directed that students "apt and eager" should be brought from the provinces and placed in proximity to the courts of law fixed by Magna Charta at Westminster. These students were accordingly located in what became known as the Inns of Court and Chancery, the latter designated by Fortescue (*De Laudibus*) as "the earliest settled places for students of the law," the germ of what Sir Edward Coke subsequently spoke of as the English judicial university. In these Inns of Court and Chancery, thus constituted, and corresponding to the ordinary college, the students, according to Fortescue, not only studied the laws and divinity, but further learned to dance, sing, and play instrumental music, "so that these hostels, being nurseries or seminaries of the court, were therefore called Inns of Court."

Stow, in his *Survey* (1598), says: "There is in and about this city a whole university, as it were, of students, practicers or pleaders, and judges of the laws of this realm;" and he goes on to enumerate the several societies, fourteen in number, then existing, corresponding nearly with those recognized in the present day, of which the Inns of Court, properly so called, are and always have been four, namely, *Lincoln's Inn*, with the subordinate Inns of Chancery, Furnival's Inn and Thavie's Inn; the *Inner Temple*, with Clifford's Inn and Clement's Inn; the *Middle Temple*, with New Inn; and *Gray's Inn*, with Staple's Inn and Barnard's Inn. In addition to these may be specified *Serjeant's Inn*, a society composed solely of serjeants-at-law, which, however, ceased to exist in 1877. Besides the Inns of Chancery above enumerated, there were others, such as Lyon's Inn, which was pulled down as recently as 1868, and Scrope's Inn and Chester or Strand Inn, spoken of by Stow, which have long been removed, and the societies to which they belonged have disappeared. The four Inns of Court stand on a footing of complete equality, no priority being conceded to or claimed by one inn over another. Their jurisdictions and privileges are equal and upon affairs of common interest the benchers of four inns meet in conference. From the earliest times there has been an interchange of fellowship between the four houses; nevertheless the Middle Temple and Lincoln's Inn, and the Inner Temple and Gray's Inn, have maintained a closer alliance.

The members of an Inn of Court consists of benchers, barristers, and students. The benchers are the governing bodies of the inns, and are composed of the senior members, designated also more formally "masters of the bench." They are self-elected, and unrestricted as to numbers; usually, but not invariably, a member of an inn, on attaining the rank of queen's counsel, is invited to the bench. Other members of long standing are also occasionally chosen, but no member by becoming a queen's counsel or by seniority of standing acquires the right of being nominated a bencher. The benchers thus elected vary in number from twenty in Gray's Inn to seventy and upward in Lincoln's Inn and the Inner Temple. The powers of the benchers are practically without limit within their respective societies; their duties, however, are restricted to the superintendence and management of the concerns of the inn, the ad-

mission of candidates as students, the calling of them to the bar, and the exercise of discipline generally over the members. The judges of the superior courts are the visitors of the inns, and to them alone can an appeal be had when either of the societies refuses to call a member to the bar, or to reinstate in his privileges a barrister who has been disbarred for professional or other misconduct. The meetings of the benchers are variously denominated a "parliament" in the Inner and Middle Temples, a "pension" in Gray's Inn, and a "council" in Lincoln's Inn. The presiding or chief officer is the treasurer, one of the benchers, who is elected annually to that dignity. Under the term barrister are included generally all those members of an Inn of Court who, after due probation, and being at least twenty-one years of age, have been called to that rank by the benchers of the inn of which they have been students.

INOCULATION. See **SMALLPOX**.

INOWRAZLAU, anciently Jung-Breslau, the chief town of a circle in the government district of Bromberg, is situated on an eminence in the most fertile part of the Prussian province of Posen, twenty-five miles southeast of the town of Bromberg. Population, 13,548.

INQUEST. See **CORONER**.

INQUISITION, THE, is the name usually given to that organization which was established in Spain in the fifteenth century for the detection and suppression of heresy. The "Holy Office," as it was styled, was, however, only the development of a system which, in the hands of the preaching orders, had existed from the beginning of the thirteenth century; and this in turn did but enforce anew the old view that the church is bound to correct all immorality or misbelief. The subject has therefore three distinct periods:—(1) the treatment of heresy and vice before the thirteenth century; (2) the Dominican Inquisition, dating from the council of Toulouse in 1229; (3) the Spanish Inquisition, which began in 1480. The second and third periods express a different principle from that which guided the first; for the earlier inquiry into heresy or vice was a part of the episcopal functions, while the second period sprang out of the anti-episcopal and anti-feudal revival of the preaching orders, and the third went with the establishment of a centralized monarchy in Spain, and its claims to a political-religious supremacy in Europe. The first was not directed against any special heresy; the second was called forth by the Albigensian movement, and the literary and artistic independence of southern France; the third expressed the views of Spanish orthodoxy in its struggle with Jew and Moor, and, when that contest was done, it attacked Protestantism, becoming, in union with the Jesuits, the fighting power of the Catholic reaction of the sixteenth century. The original episcopal Inquisition never forgave its more vigorous and better organized successor; the Spanish Office was nowhere introduced without a struggle, but the Reformation left episcopacy almost powerless in northern Europe, while in the south the renewed and autocratic papacy discouraged the independence of bishops, and trusted itself mainly to the order of Jesus and the Holy Office.

The germ of the Inquisition lies in the duty of searching out and correcting error intrusted to the deacons in the early churches. The promise in the Anglican Ordinal that the priest will be "ready with all faithful diligence to banish and drive away all erroneous and strange doctrines contrary to God's word" is a pale reflection of this ancient charge. The episcopacy thus providing the instruments, temporal power soon offered to enforce the sentences of the church; the edicts of Constantine and his successors now began that double system which, by

ordaining that heretics should be dealt with by the secular arm, enabled the church to achieve her object without dipping her own hands in blood. Thus, about 316, Constantine issued an edict condemning Donatists to lose their goods; and in 382 Theodosius declared the Manichæans deserving death, and confiscated their goods. Later on, in 769, we learn in the capitularies of Charles the Great that each bishop must visit all his diocese, teach truth, correct morals, see that the clergy hold the right faith, and, on the Saxon border, stop the use of any pagan rites. Charles the Bald in 844 orders the bishops to preach and confirm the people, and to inquire into and correct their errors. In this inquisition, as in other matters, the church long felt the impress of the organizing power of Charles the Great; it helped forward the episcopal dominance in the ninth and tenth centuries.

But when a time of new life came to Europe early in the thirteenth century, and orthodoxy was threatened by the brilliant speculations of southern France, a great revival in the church met the independent movement outside, and the rise of the Preaching Friars gave a new direction to the relations between religion and the world. To this period we owe the technical use of the terms Inquisitor and Inquisition. Hitherto they had signified, specially in France, officers inquiring into matters of taxation; henceforth they are applied to the more ominous inquiry into orthodoxy. At the council of Tours in 1163, in the time of Alexander III., the title of Inquisitor was first applied in this sense. But the thing was far older than the name. In 1184 the synod of Verona cursed all heretics and their shelterers, ordered relapsed persons to be handed over to the secular arm for capital punishment, confiscated their property, and clearly indicated that the New Inquisition would go far beyond the older episcopal function. The synod did not hesitate to threaten easy-going bishops, urging them to more frequent and more searching visitations, standing over them as a superior power. And henceforward Inquisition became more systematized, with papal not episcopal authority; it was developed by those three masterful pontiffs, Innocent III. (1198-1216), Gregory IX. (1227-1241), and Innocent IV. (1243-1254), who all, regarding the supremacy of Rome as the keystone of society, claimed authority over men's souls and bodies, above the authority of prince or bishop.

But little success attended the efforts of the earlier Inquisitors till they were joined by the too famous Castilian Dominic, who, having in 1215 accompanied the bishop of Toulouse to Rome, laid before the pope a scheme for a new order of preaching friars, whose special function should be the overthrow of heresy. Innocent III. approved the order in 1215, and Honorius III. confirmed it 1216. It spread swiftly through Europe, and the charge of the Inquisition was soon intrusted almost entirely to it. Hitherto there had been no regular tribunal; now, as the war in southern France went on and the strife became more fierce, a stricter organization was introduced. While the strong current of independent opinion was being stemmed in Italy, Provence, France, and Spain, the resistance gave compactness to the new system. St. Dominic established three orders—(1) his friars, (2) a female order, and (3) the "Militia of Christ," an order of laymen, married chiefly, and noble, who became the working force of the inquisitorial system. They were also styled "the Familiars of the Holy Office."

It is, however, to Gregory IX. that the Inquisition owes its definite form. In the synod of Toulouse in 1229 it was agreed that each bishop should appoint one priest, and one, two, three, or even more laymen, to inquire, under oath and with much secrecy, into heresy.

In 1234 the Dominicans were specially intrusted with the inquisitorial office in Toulouse. From their tribunal there was no appeal to the bishop, who fell into the background, all appeals being directed to Rome alone. To this end Urban IV. appointed, in 1263, an inquisitor-general to be the medium of communication between the papacy and the local inquisitors, in hopes of stopping the delay of business caused by the absence of officials in Rome on appeal questions. This office, however, fell into abeyance till revived by Paul III. in the person of Caraffa in 1542.

From Provence the organization of the Inquisition soon passed into France, where, in 1255, Alexander IV. named the provincial of the Dominicans and the head of the Franciscans at Paris his inquisitors-general for France at the urgent request of Saint Louis, whose piety was of the narrowest crusading type. The Gallican Church stoutly resisted this ultramontane interference; the bishops gave it no help; churches and abbeys became asylums for the victims of the Holy Office; and the new movement had consequently but very partial success. It was more effectively used by Philip the Fair to crush the Templars, though that greedy prince quickly interfered when he found the Inquisition laying hands on his special preserve, the wealthy Jews. Charles V., moved to new efforts by Gregory XI., imprisoned large crowds of Frenchmen for heresy, and to meet the pressure erected several new prisons, among them the ill-omened Bastille. After this the Inquisition was quiet in France till the Reformation once more aroused it in the time of Francis I. In Spain it was introduced by Pope Gregory IX., in 1232, and had a far more active and continuous life; we have a minute account of its system and procedure in the *Directorium Inquisitorium* of N. Eymerich, inquisitor-general for Castile in 1356. This work, based entirely on the writer's personal knowledge and experience, gives us full insight into the way in which cases were got up and handled; we see the spy system, the delation, the mysterious secrecy, the scandal of the "question;" the shameless union in one person of accuser and judge, the unscrupulous hindrances put in the way of the victim's defense, the direct interest of the tribunal in condemning—for condemnation affirmed vigilance and orthodoxy, while it secured to the Holy Office the wealth of the accused, and the accused were usually among the wealthiest in the land. We can trace the absolute injustice of the institution on every page, and must only wonder that even in those days men could endure its existence. In Italy the Inquisition was established under Dominican supervision as early as 1224; Simone Memmi's famous fresco of the "Domini Canes" in S. Maria Novella at Florence, with its black and white hounds chasing off the wolves from the holy fold, bears living witness to the power of the institution and its influence over the Italian imagination. Inquisitors were at a later time brought into England to combat the Wickliffite opinions.

Though it succeeded, with help of the terrible lay-crusade, in southern France, the Inquisition seemed unequal to the problem laid before it in Spain, where, instead of simple-hearted Albigensians, it had to deal with rich and crafty Jews and highly-trained Moors. Forced to profess a Christianity which they hated, they loathed the worship of Virgin or saint, the pictured or graven effigy of the Christ, the thousand objects of mediæval worship, all which to their eyes were mere idolatries; their allegiance to such a faith was that of compulsion, which fostered the bitterest sense of wrong. Between them and the old Catholic Spaniards smoldered a perpetual grudge; the Inquisition seemed unable to overcome the evil. When, however, Castile and Aragon were united by Ferdinand and Isabella, political aims as

well as religious fanaticism demanded more stringent measures against independent thought; the war of Louis XIV. against freedom of opinion was not more distinctly political than that of the two monarchs, although his machinery was more civil and military than theirs.

Three chief motives led to the reorganization of the Inquisition in Spain:—(1) the suspicions and ill-feeling against the new Christians; (2) the wish of Ferdinand and Isabella to strengthen the compactness of their union, threatened by the separatist tendencies of the wealthy Jews and Moors; and (3) above all, the hope of a rich booty from confiscations, a characteristic which specially marks the history of the Spanish Inquisition. The motive of strictly religious fanaticism influenced, not the monarchs, but the Dominican instruments of the Holy Office. And so when in 1477 Friar Philip de Barberi, inquisitor for Sicily, came to Seville for the confirmation of his office, and pressed on Ferdinand the great advantages of a revived system on the Sicilian plan, the king, led by his hunger for gold, and the queen, guided by her piety, were easily persuaded, and sent to Rome to solicit the establishment of such a tribunal as Barberi suggested. Sixtus IV. in 1478 acceded to their request; his bull for this purpose is, however, lost. But as Isabella wished first to try gentler measures, and as both monarchs were rather alarmed by the independence the proposed tribunal claimed, the papal permission was not made known or acted on till 1480. The monarchs bargained that they should nominate the inquisitors, hoping thereby to secure a control over the institution; but the real center of authority was inevitably Rome, and from its outset the Holy Office was ultramontane.

The first inquisitors, named in 1480, were Dominicans; their tribunal was established at Seville, where they were but sullenly received. Early in 1481 they began work, and, before that year was out, had burnt 298 victims in Seville alone, besides many effigies of those who had happily escaped. The Jesuit historian Mariana assures us that in this year full 2,000 were burnt in the archbishopric of Seville and the bishopric of Cadiz; the Quemadero, or cremation-place, built at this time by the prefect of Seville, not far from that city, a square platform of stone, was a grim altar on which the lives of almost daily victims ascended in clouds of smoke to heaven. This new blessing, however, was but unwillingly welcomed by the Spaniards; the capital of Castile remembered its ancient learning and splendor and the wealth and intelligence of its old Moorish inhabitants; complaints and protests poured in on Sixtus IV., especially from the bishops; and in 1483, in one of his briefs, the pope actually ordered a softening of the rigors of the Holy Office; he also named the Archbishop of Seville, D. Inigo Manriquez, his sole judge of appeals in matters of faith, hoping thereby to still the strong jealousy of the episcopate. He was also somewhat offended because Ferdinand and Isabella held back the papal share of the spoils.

Shortly afterward, October, 1483, the Dominican father Thomas of Torquemada (de Turrecremata) was named by Sixtus IV. inquisitor-general for Castile and Leon. From him the institution received its full organization. He became its president; by his side were two lawyers as assessors, and three royal counselors. This scheme was not large enough for the work; it was shortly amended, and there was now a central court styled the Consejo de la Suprema, composed of the grand inquisitor-general, six apostolical counselors, a fiscal procurator, three secretaries, an alguazil (or head policeman), a treasurer, four servants of the tribunal, two reporters or informers, and as many consultants as

might be needful. Under this central tribunal four local tribunals were also appointed. All the officials were well paid from the confiscation fund; it was the interest of all that that stream of wealth should never run dry; Torquemada was to the full as eager as Ferdinand for profit from this unholy source: the chief spoils of the institution fell to the crown; the true accession of strength was at Rome.

This royal council of the Inquisition, as it was now styled, proceeded next to draw up its rules. Torquemada, in 1484, summoned to Seville all heads of local tribunals, who presently published a code of thirty-nine articles. The dreary list regulates the procedure of the Holy Office. The articles were originally twenty-eight; of these 1 to 10 deal with the summons to heretics to come forward and confess, and with the penalties to the submissive; 11 to 13 with penitents in the prisons of the Office; 14 to 19 treat of the procedure of trial, including torture; 20 and 21 extend the jurisdiction of the tribunal to dead heretics and the vassals of living nobles; the remainder are on points of detail in the management.

The Holy Office had now free scope for its work, and its procedure, arranged by Torquemada, will explain how thoroughly it succeeded in terrifying all who came within its reach. When an accused or suspected person was first delated to the Inquisition, a preliminary inquiry was held, and the result of it laid before the tribunal. If the tribunal thought it a case for interference, and it usually did so, the informers and witnesses were reexamined, and their evidence, with all suspicious circumstances which zeal could rake together, drawn out and submitted to a body of monastic theologians called "the Qualifiers of the Holy Office." The character of these officials was at stake, and their honor involved; they could hardly be expected to report well of the accused, or there might be a suspicion of their own orthodoxy. When they had given in their opinion against the accused, he was at once removed to the secret prison of the office, where all communication with the outer world was entirely cut off from him. Then followed three "first audiences," in which the officials did their utmost to wring a confession out of him, so that he might be made to rank as a penitent, and enjoy the charity of his persecutors. If, however, he was stiff, the charges against him were re-formed, and the fiscal in charge of the case demanded torture to extort confession. This in the early times of the institution followed frequently, and had many forms of ingenious cruelty, as to which Llorente, who had good means of judging, declares that "none of the descriptions of them can be accused of exaggeration." After torture, the shattered victim was carried to the audience chamber, and called on to make his answer to the charges, which were now read to him for the first time. He was next asked whether he desired to make any defense. If so, he had to choose a lawyer from a list of those employed by his accusers, and the defense was little but a mockery. After this process, which sometimes lasted for months, the qualifiers were again called in, and gave their final opinion, which was almost always adverse, on the whole case. Then followed the sentence, with opportunity of an appeal either to the "Suprema"—which was useless, as being an appeal to the tribunal again—or to Rome. The papal treasury by these appeals obtained a large income; for money was the only valid argument. Thus the Inquisition got the victim's property by confiscation, and the papacy the wealth of his friends in the appeal. If the sentence was, as did sometimes occur, an acquittal, the poor wretch might slink home without redress or recompense for imprisonment, and the agony of the trial and the torture; if it was a condemnation, the victim was made the center of an *auto-da-fé*, dressed in

a sanbenito, or condemned man's robe, and eventually, at the open place of execution, informed as to his fate. He might be either "reconciled," and then, as a penitent, had to undergo penalties almost worse than death, or "relaxed," that is, handed over to the secular arm for burning—for the Holy Office shed no blood.

In 1492 the great work began with the persecution and expulsion of the Jews; they were ejected, and their wealth confiscated. There was an enormous crowd of exiles, who wandered to different shores of the Mediterranean, carrying misery and plague in their train. A few years later, under supervision of Cardinal Ximenes, the Moors were also ordered to be converted or to go; the Morescoes, or Christianized Moors, suffered constant persecution throughout the sixteenth century, until finally they, too, were expelled by Philip III. in 1609. Jews, Moors, and Morescoes made up over 3,000,000 of the wealthiest and most intelligent inhabitants of Spain; the loss in trade, agriculture, and manufactures was incalculable; in seventy years the population fell from 10,000,000 to 6,000,000.

The hand of the Holy Office was stretched out against all; no lofty dignity in church or state, no eminence in art or science, no purity of life, could defend from its attacks. It is said to have threatened Charles V. and Philip II.; it persecuted Archbishop Carranza, head of the church in Spain; destroyed De Dominis, archbishop of Spalatro; it smote Galileo, murdered Giordano Bruno, attacked Pico di Mirandola, and even is said to have threatened Cæsar Borgia. With equal vigor, in combination with the Jesuits, the Inquisition made war on books and learning, religious or secular alike; we have seen how baleful was its effect in earlier days on literature and art in Provence, and in the time of the Catholic sovereigns on the material well-being of Spain. "In the love of Christ and his maid-mother," says Queen Isabella, "I have caused great misery, and have depopulated towns and districts, provinces and kingdoms."

The statistics of death at the hands of the Inquisition in Spain given by Llorente show how the institution gradually lost force; the average number in each year steadily diminished after the beginning of the seventeenth century; and in the eighteenth torture was abandoned, and the deaths dropped to two or three or even less in the year. In Italy it was abolished in Parma and Tuscany about 1769, in Sicily in 1782; the spirit of the eighteenth century was all against the Office, though it lingered on. In the Revolution wars Napoleon sternly crushed it wherever he came across it, in Spain in 1808, and in Rome in 1809. Down to 1809 Llorente gives as the figures for Spain alone—burnt alive 31,912, in effigy 17,659, and imprisoned, etc., as penitents, 291,450—a total of 341,021. After the hand of Napoleon was taken off, the institution revived again at Rome and at Madrid; but its teeth were gone; and it could do little but show a murderous will. The last capital punishments were those of a Jew who was burnt, and a Quaker schoolmaster hanged in Spain in 1826. Still its voice is sometimes heard. In 1856 Pius IX. issued an encyclical against somnambulism and clairvoyance, calling on all bishops to inquire into and suppress the scandal, and in 1865 he uttered an anathema against Freemasons, the secular foes of the Inquisition.

INSANITY is a generic term applied to certain morbid mental conditions produced by defect or disease of the brain. The synonyms in more or less frequent use are mental disease, alienation, derangement or aberration, madness, unsoundness of mind. There are many diseases of the general system productive of disturbance of the mental faculties which, either on account of their transient nature, from their being associated

with the course of a particular disease, or from their slight intensity, are not included under the head of insanity proper. From a strictly scientific point of view it cannot be doubted that the fever patient in his delirium, or the drunkard in his excitement or stupor, is insane—that, the brain of either being under the influence of a morbid agent or of a poison, the mental faculties are deranged; yet such derangements are regarded as functional disturbances, *i.e.*, disturbances produced by agencies which experience tells will, in the majority of cases, pass off within a given period without permanent results on the tissues of the organ. The comprehensive scientific view of the position is, that all diseases of the nervous system, whether primary or secondary, congenital or acquired, should, in the words of Griesinger, be regarded as one inseparable whole, of which the so-called mental diseases comprise only a moderate proportion. However important it may be for the physician to keep this principle before him, it may be freely admitted that it cannot be carried out fully in practice, and that social considerations compel the medical profession and the public at large to draw an arbitrary line between such functional diseases of the nervous system as hysteria, hypochondriasis and delirium on the one hand, and such conditions as mania, melancholia and dementia on the other.

All attempts at a short definition of the term insanity have proved unsatisfactory; perhaps the nearest approach to accuracy is attained by the rough statement that it is *a chronic disease of the brain, inducing chronic disordered mental symptoms*—the term disease being used in its widest acceptance. But even this definition is at once too comprehensive, as under it might be included certain of the functional disturbances alluded to, and too exclusive, as it does not comprehend certain rare transitory forms. Still, taken over all, this may be accepted as the least defective short definition; and moreover it possesses the great practical advantage of keeping before the student the primary fact that insanity is the result of disease of the brain, that it is not a mere immaterial disorder of the intellect. In the earliest epoch of medicine the corporeal character of insanity was generally admitted, and it was not until the superstitious ignorance of the Middle Ages had obliterated the scientific, though by no means always accurate, deductions of the early writers that any theory of its purely psychical character arose. At the present day it is unnecessary to combat such a theory, as it is universally accepted that the brain is the organ through which mental phenomena are manifested, and therefore that it is impossible to conceive of the existence of an insane mind in a healthy brain. On this basis insanity may be defined as consisting in *morbid conditions of the brain, the results of defective formation or altered nutrition of its substance induced by local or general morbid processes, and characterized especially by non-development, obliteration, impairment, or perversion of one or more of its psychical functions*. Thus insanity is not a simple condition; it comprises a large number of diseased states of the brain, which have been gathered under one popular term on account of mental defect or aberration being the predominant symptom.

The insanities are sharply divided into two great classes—the Congenital and the Acquired. Under the head of Congenital Insanity fall to be considered all cases in which, from whatever cause, brain development has been arrested, with consequent impotentiality of development of the mental faculties; under that of Acquired Insanity all those in which the brain has been born healthy, but has suffered from morbid processes affecting it primarily, or from diseased states of the general system implicating it secondarily.

In most treatises on the subject will be found discussed the bearing which civilization, nationality, occupation, education, etc., have, or are supposed to have, on the production of insanity. Such discussions are generally eminently unsatisfactory, founded as they are on common observation, broad generalizations, and very imperfect statistics. As they are for the most part negative in result, at the best almost entirely irrelevant to the present purpose, it is proposed merely to shortly summarize the general outcome of what has been arrived at by those authorities who have sought to assess the value to be attached to the influence exercised by such factors, without entering in any detail on the theories involved.

(1) *Civilization*.—Although insanity is by no means unknown among savage races, there can be no reasonable doubt that it is much more frequently developed in civilized communities; also that, as the former come under the influence of civilization, the percentage of lunacy is increased. This is in consonance with the observation of disease of whatever nature, and is dependent in the case of insanity on the wear and tear of nerve tissue involved in the struggle for existence, the physically depressing effects of pauperism, and on the abuse of alcoholic stimulants; each of which morbid factors falls to be considered separately as a proximate cause. (2) *Nationality*.—In the face of the imperfect social statistics afforded by most European and American nations, and in their total absence or inaccessibility among the rest of mankind, it is impossible to adduce any trustworthy statement under this head. (3) *Occupation*.—There is nothing to prove that insanity is in any way connected with the prosecution of any trade or profession *per se*. Even if statistics existed (which they do not) showing the proportion of lunatics belonging to different occupations to the 1,000 of the population, it is obvious that no accurate deduction *quoad* the influence of occupation could be drawn. (4) *Education*.—There is no evidence to show that education has any influence over either the production or the prevention of insanity. The general result of discussions on the above subject has been the production of a series of arithmetical statements, which have either a misleading bearing or no bearing at all on the question. In the study of insanity statistics are of slight value from the scientific point of view, and are only valuable in its financial aspects.

Of much greater importance is the question of hereditary predisposition to nervous disease. There is a general and warrantable position taken up by the medical profession, founded on the observation of ages, that a constitutional condition may be generated in a family, which, although it may never manifest itself in a concrete form of disease, may materially influence development, or may make itself felt in a more subtle manner by a mere tendency to degenerative changes. In this wise hereditary predisposition may be regarded as a common factor in all insanities—in the congenital class as an arrester of brain development, in the acquired as the producer of the nervous diathesis. How the constitutional condition is generated, and in what its pathological nature consists, is beyond the ken of science; it may in fact be freely admitted that the proof of its existence hangs more on popular observation than on scientific evidence. The observation is not confined to the nervous system; it extends itself to others, as is shown by hereditary predisposition to gout, consumption, cancer, and other diseases.

It has been strongly asserted that consanguineous marriage is a prolific source of nervous instability. There is considerable diversity of opinion on this subject; the general outcome of the investigations of many careful inquirers appears to be that the offspring of

healthy cousins of a healthy stock is not more liable to nervous disease than that of unrelated parents, but that where there is a family history of diathesis of any kind there is a strong tendency in the children of cousins to degeneration, not only in the direction of the original diathesis, but also toward instability of the nervous system. The objection to the marriage of blood relations does not rise from the bare fact of their relationship, but has its ground in the fear of their having similar vitiations in their constitution, which, in their children, are prone to become intensified. There is sufficient evidence adducible to prove that close breeding is productive of degeneration; and when the multiform functions of the nervous system are taken into account, it may almost be assumed not only that it suffers concomitantly with other organs, but that it may also be the first to suffer independently.

Of the other causes affecting the parents which appear to have an influence in engendering a predisposition to insanity in the offspring, the abuse of alcoholic stimulants and opiates, over-exertion of the mental faculties, advanced age, and weak health may be cited. Great stress has been laid on the influence exercised by the first of these conditions, and many extreme statements have been made regarding it. Such must be accepted with reserve, for, although there is reason for attaching considerable weight to the history of ancestral intemperance as a probable causating influence, it has been generally assumed as the proved cause by those who have treated of the subject without reference to other agencies which may have acted in common with it, or quite independently of it. The question has not as yet been fairly worked out. However unsatisfactory from a scientific point of view it may appear, the general statement must stand, that whatever tends to lower the nervous energy of a parent may modify the development of the progeny. It is merely a matter of probabilities in a given case.

Constitutional tendency to nervous instability once established in a family may make itself felt in various directions—epilepsy, hysteria, hypochondriasis, neuralgia, certain forms of paralysis, insanity, eccentricity. It is asserted that exceptional genius in an individual member is a phenomenal indication.

Confined to the question of insanity, this morbid inheritance may manifest itself in two directions—in defective brain organization manifest from birth, or from the age at which its faculties are potential—*i.e.*, congenital insanity; or in the neurotic diathesis, which may be present in a brain to all appearance congenitally perfect, and may present itself merely by a tendency to break down under circumstances which would not affect a person of originally healthy constitution.

In systematic works and in asylum reports, it has been too much the fashion to accept the evidence of the existence of insanity in a relative as a proof of hereditary predisposition in a given case. In estimating the value to be attached to such histories, two things must be taken into account—first, the amount and quality of proved ancestral nervous disease, and, secondly, the period of life at which it appeared in the alleged insane ancestor. Take, for instance, the case of a lunatic whose father or mother is reported to have died insane; this may be true in fact, but may still have no bearing on the causation of the patient's insanity; for the parent may have been the subject of mental disease at a period subsequent to the birth of the child, he may have drunk himself into alcoholic mania late in life, or disease of the cerebral arteries in old age may have produced senile insanity. It is difficult to limit the remoteness of relationship in tracing hereditary predisposition, mainly from the fact that it

frequently skips a generation. As a rule it does not confine itself to a single individual of a family, but makes itself felt in one form or another in several members. According to Esquirol and Baillarger, it is more frequently transmitted through the female than through the male branch, but this opinion is called in question by Koch of Würtemberg, whose statistics show that hereditary tendency to insanity acts more strongly through the father than through the mother.

CONGENITAL INSANITY.

The morbid mental conditions which fall to be considered under this head are *Idiocy* (with its modification *Imbecility*) and *Cretinism*.

Idiocy.—In treating of idiocy it must be carefully borne in mind that we are dealing with mental phenomena disassociated from active bodily disease, and that, in whatever degree it may exist, we have to deal with a brain condition fixed by the pathological circumstances under which its possessor came into the world, or by such as had been present before full cerebral activity could be developed, and the symptoms of which are not dependent on the intervention of any subsequent morbid process. From the earliest ages the term *Amentia* has been applied to this condition, in contradistinction to *Dementia*, the mental weakness following on acquired insanity.

The causes of congenital idiocy may be divided into four classes:—(1) hereditary predisposition, (2) constitutional conditions of one or both parents affecting the constitution of the infant, (3) injuries of the infant head prior to or at birth, and (4) injuries or diseases affecting the infant head during infancy. All these classes of causes may act in two directions; they may produce either non-development or abnormal development of cranial bones, as evidenced by microcephalism, or by deformity of the head; or they may induce a more subtle morbid condition of the constituent elements of the brain. As a rule, the pathological process is more easily traceable in the case of the last three classes than in the first. For instance, in the case of constitutional conditions of the parents we may have a history of syphilis, a disease which often leaves its traces on the bones of the skull; and in the third case congenital malformation of the brain may be produced by mechanical causes acting on the child in utero, such as attempts to procure abortion, and deformities of the maternal pelvis rendering labor difficult and instrumental interference necessary. In such cases the bones of the skull may be injured; it is only fair, however, to say that more brains are saved than injured by instrumental interference. With regard to the fourth class, it is evident that the term congenital is not strictly applicable; but, as the period of life implicated is that prior to the potentiality of the manifestation of the intellectual powers, and as the result is identical with that of the other classes of causes, it is warrantable to connect it with them, on pathological principles more than as a mere matter of convenience.

Dr. Ireland, in his work *On Idiocy and Imbecility*, classifies idiots from the standpoint of pathology as follows: (1) Genetous idiocy; in this form, which he holds to be complete before birth, he believes the presumption of heredity to be stronger than in other forms; the vitality of the general system is stated to be lower than normal, the palate is vaulted and narrow, the teeth misshapen, wrongly placed and prone to decay, and the patient dwarfish in appearance; the head is generally unsymmetrical, and the commissures occasionally atrophied; (2) Microcephalic idiocy, a term which explains itself; (3) Eclampsic idiocy, due to the effects of infantile convulsions; (4) Epileptic idiocy; (5) Hydrocephalic

Idiocy, due to water on the brain; (6) Paralytic idiocy, a rare form, due to the brain injury causing the paralysis; (7) Traumatic idiocy, a form produced by the third class of causes above mentioned; (8) Inflammatory idiocy; (9) Idiocy by deprivation of one or more of the special senses.

The general conformation of the idiot is often very imperfect; he is sometimes deformed, but more frequently the frame is merely awkwardly put together, and he is generally of short stature. Only about one-fourth of all idiots have heads smaller than common. Many cases are on record in which the cranial measurements exceed the average. It is the irregularity of development of the bones of the skull, especially at the base, which marks the condition. Cases, however, often present themselves in which the skull is perfect in form and size. In such the mischief has begun in the brain matter. The palate is very often highly arched, in some cleft; hare-lip is not uncommon; in fact congenital defect or malformation of other organs than the brain is more commonly met with among idiots than in the general community. Of the special senses, hearing is most frequently absent. Sight is good, although coördination may be defective. Many are mute. On account of the mental dullness it is difficult to determine whether the senses of touch, taste and smell suffer impairment; but the impression is that their acuteness is below the average. It is needless to attempt a description of the mental phenomena of idiots, which range between utter want of intelligence and mere weakness of intellect.

The treatment of idiocy and imbecility consists almost entirely of attention to hygiene, and the building up of the enfeebled constitution, along with endeavors to develop what small amount of faculty exists by patiently applied educational influences. The success which has attended this line of treatment in many of our public and private institutions has been very considerable. It may be safely stated that all idiotic or imbecile children have a far better chance of amelioration in asylums devoted to them than by any amount of care and teaching lavished upon them at home.

In the class of idiots just spoken of imperfect development of the intellectual faculties is the prominent feature—so prominent that it masks the arrest of potentiality of development of the moral sense, the absence of which, even if noticed, is regarded as relatively unimportant; but in conducting the practical study of congenital idiots, a class presents itself in which the moral sense is wanting or deficient, while the intellectual powers are apparently up to the average. It is the custom of writers on the subject to speak of "intellectual" and "moral" idiots. The terms are convenient for clinical purposes, but the two conditions cannot be disassociated, and the terms therefore severally only imply a specially marked deprivation of intellect or moral sense in a given case. The everyday observer has no difficulty in recognizing as a fact that deficiency in receptive capacity is evidence of imperfect cerebral development; but it is not so patent to him that the perception of right and wrong can be compromised through the same cause, or to comprehend that loss of moral sense may result from disease. The same difficulty does not present itself to the pathologist; for, in the case of a child born under circumstances adverse to brain development, and in whom no process of education can develop an appreciation of what is right or wrong, although the intellectual faculties appear to be but slightly blunted or not blunted at all, he cannot avoid connecting the psychical peculiarity with the pathological evidence. The world is apt enough to refer any fault in intellectual development, manifested by imperfect recep-

tivity, to a definite physical cause, and is willing to base opinion on comparatively slight data; but it is not so ready to accept the theory of a pathological implication of the intellectual attributes concerned in the perception of the difference between right and wrong. Were, however, two cases pitted one against another—the first, one of so-called intellectual, the second, one of so-called moral, idiocy—it would be found that, except as regards the psychical manifestations, the cases might be identical. In both there might be a family history of tendency to degeneration of the nervous system, a peculiar cranial conformation, a history of nervous symptoms during infancy, and of a series of indications of mental incapacities during adolescence, differing only in this, that in the first the prominent indication of mental weakness was inability to add two and two together, in the second the prominent feature was incapacity to distinguish right from wrong. What complicates the question of moral idiocy is, that many of its subjects can, when an abstract proposition is placed before them, answer according to the dictates of morality, which they may have learnt by memory. If asked whether it is right or wrong to lie or steal they will say it is wrong; still, when they themselves are detected in either offense, there is an evident non-recognition of its concrete nature. The question of moral idiocy will always be a moot one between the casuist and the pathologist; but, when the whole natural history of such cases is compared, there are points of differentiation between them and mere moral depravity which must appeal to even biased observers. Family history, individual peculiarities, the manifest imbecility of the acts committed, the general bizarre nature of the phenomena, remove such cases from the ordinary category of crime.

Cretinism.—*Crétin* probably comes from *Chrétien*, either from the idea that the person was innocent in the sense in which that word is employed occasionally to imply a person who cannot sin, or from the religious respect in which cretins were held. Cretinism is a form of congenital insanity inasmuch as the cretino genetic miasma acts before birth; it is endemic in many mountainous countries, and is said to occur most frequently on magnesian limestone formations, but never at an elevation above 3,000 feet. Although all cretins have not goitre, and all goitrous persons are not cretins, there is a very intimate relationship between the two conditions. The districts in Europe in which it is most common are the departments of Hautes-Pyrénées, Haute-Savoie, and Hautes-Alps; Styria, Upper Austria, the province of Aosta, and Sardinia. It is found more sparsely in other parts of Europe, and also among the Himalayas and Andes. It occasionally presents itself in flat countries—a remarkable instance being the island of Niederwerth below Coblenz, where out of 750 inhabitants there are 131 cretins. Notwithstanding the circumscribed area in which this disease exists, affording, it might be supposed, data founded on the conditions of life common to their inhabitants for arriving at conclusions as to its cause, nothing has been definitely determined. Cretinism has occupied the attention of many eminent observers, but the various theories they have advanced have been in succession overturned. It has been suggested that the condition is due to the constant use of snow-water, or to the presence of sulphate of iron or of lime in water, but none of these theories admit of universal application. That the disease is due to some geological or climatic cause appears certain from the fact, stated by Baillarger, that it disappears from a family in one or two generations after removal to a healthy climate, and may even be prevented by the gravid mother leaving a valley where it is rife for localities where cretinism is unknown. The physical and

mental symptoms of cretinism are so closely allied in essentials to those of congenital idiocy as not to demand a separate description. The marked features of the disease are its endemic nature and its intimate connection with goitre. (See CRETINISM.)

ACQUIRED INSANITY.

Pathology.

It is predicated in treating of Acquired Insanity that we have to deal with brains congenitally perfect, the exercise of whose functions has been normal until the incidence of disease. The purely nervous structures of the brain consist of very delicate fibers and cells, the latter occurring only in the gray matter. It is richly supplied with blood vessels, the supply being six times greater to the gray matter than to the white. These tissues are supported and separated one from the other by a connective tissue, or interstitial matter, the *neuroglia*; the whole organ is enveloped in membranes which separate it from the skull. By one system of independent fibers (the expansion system) communication is maintained between the spinal cord, the central ganglia, and the cortical gray matter; by a second system of fibers (the commissural), corresponding and identical regions of the gray matter of the two opposite hemispheres are united; and by a third system (the horizontal) communication is maintained between the parts of the same hemisphere. The cells communicate one with the other by means of processes or poles, fine projections from the body of the cell. The observations of Cleland and Boll show that the apical processes become connected with the fibers as they go to the periphery; the basal processes loop with the horizontal fibers, and also, by means of their recurrent poles, with those of the expansion series. But it is of great importance to observe that we have no evidence of fiber communicating directly with fiber, or no certain proof that one series of fibers communicates directly with others; in fact, all anatomical demonstration goes to prove the individuality and isolation of fiber, the processes of the cell being the connecting link. It is universally accepted that the cerebral cells possess the vital property of generating, receiving, and transmitting nervous influences, and that the fibers are the organs by means of which these influences are received and communicated. The term *mind* may be applied to the combination of all the actual and possible states of consciousness of the organism. We have a right to presuppose that in the brain, as in other organs of the body, the normal exercise of function is dependent on a perfect maintenance of the anatomical relations of the component structures, and conversely that morbid conditions of these structures must affect the whole economy more or less seriously. In studying brain pathology it must be kept in view that the brain cannot, like the lungs, liver, and kidneys, cast any of its functions on other organs; it must do its own work, rid itself of effete matter, and of the products of injury or disease, and provide within itself for the resumption of functions, the exercise of which has become impaired from whatever cause.

Solutions of continuity, preventing perfect maintenance of the component cerebral tissues, may arise from—(1) idiopathic causes, *i.e.*, causes originating primarily in the brain; (2) traumatic causes (injury to the head); (3) the effects of other neuroses (morbid nerve conditions); (4) adventitious products (tumors, etc.); (5) morbid conditions of the general system secondarily implicating the brain; (6) evolutionary conditions of the system concurrently affecting the brain; (7) toxic agents (poisons). In the case of insanity the results of morbid action are confined to the convolutions of the superior surface of the brain and to the upper part of its lateral aspects:

for the most part its base and inferior lateral aspects and the cerebellum are unaffected. It is true that in old standing cases the central ganglia present lesions, but these are for the most part secondary, and are due to the action of disease in the superior convolutions.

I. Idiopathic changes occur from disease affecting the tissues, the cause of which it may be impossible to trace,—as, for instance, acute inflammation, which, however, is not a frequent cause of insanity. Diffused subacute inflammation is held to be a much more fruitful cause, producing increase (sclerosis) of the neuroglia, degeneration of the cells, destruction (atrophy) and displacement of fibers, and aneurism, distortion, and obliteration of vessels.

A large and important class of causes of idiopathic morbid action is due to over-excitation of the brain. The causes of over-excitation of the brain functions are those which, in most works on insanity, are spoken of as “moral” (grief, anxiety, domestic complications, disappointment, terror, sorrow or joy, religious or political excitement, the exercise of the mental faculties by study unduly prolonged or conducted under adverse circumstances) in contradistinction to “physical” causes—a distinction which implies some material difference in their method of operation. To the most superficial observer, the deformed head of the idiot, and the paralysis of mind and body which follows on the rupture of a cerebral vessel, are coarsely material conditions; but when mental aberration follows on mental excitement, men are prone to regard it more as a derangement of function than as an evidence of deterioration of brain structure. If, however, we give due weight to the results of physiological research, the matter is not quite so obscure. Arguing from the analogies of other organs and from direct observation, there is reason to believe that when the brain functions are being actively exerted there is a dilatation of the vessels and an increased blood supply (hyperæmia) to its superior and lateral surfaces. This functional hyperæmia is caused by the direct action of the cerebral cells, which, along with the sympathetic system of nerves, exercise control over the muscular coats of the arteries, the immediate regulators of blood supply to any given part. Control over muscular tissue implies, of course, control in two directions, dilatation and contraction. Functional hyperæmia is in every respect a healthy condition, one necessary for the provision of temporary nutriment during temporary action, ceasing with the withdrawal of stimulus, when the caliber of the vessels is reduced to its original dimensions through the contracting influence of the cells. But if the excitement is unduly prolonged a new result appears; the cells themselves become exhausted, and therefore, even if the stimulus is withdrawn, they are unable to assert their ordinary control over the arterial muscular coats in the direction of contraction, so that the increased blood supply continues although the stimulus which caused it has been removed. Instead of functional hyperæmia we have a hyperæmia caused, not by functional excitement, but by exhaustion of the controlling organs. In a minor degree the results of this condition are matters of everyday observation; overtaxation of the brain functions, by study for instance, is very generally followed by sensations of fullness and aching of the head, loss of sleep, and general exhaustion—a condition which is recovered from when the primary irritation is withdrawn, *i.e.*, when the arteries reacquire healthy tone. But if relief from the causes of irritation is not obtained, a sequence of events ensues tending to deterioration of tissue. In the first place, sleep, the condition necessary for rest and recuperation of the cells, becomes unattainable. Physiological research has shown that during sleep the supply of

blood to the brain is diminished (anæmia), that anæmia is necessary for, and hyperæmia is inimical to, its production. Further deterioration of cell activity follows on non-recuperation, and concomitant diminished control over the vessels tends to the establishment of morbid hyperæmia and more or less blood stagnation (stasis).

By this exposition of a probable sequence of pathological events it is desired to indicate that disturbance of function directly referable to over-excitation of the brain is not a mere functional derangement, not a mere morbid increase of a normal emotion, but that it is the manifestation of a pathological condition—that, in effect, so-called moral causes may be the producers of physical cerebral disease. This meets with support from the clinical observation that, with very rare exceptions, a considerable period of time elapses between the incidence of the moral cause and the first indication of mental alienation—an interval during which sleep has been absent in consequence of continued hyperæmia. Instances of melancholy or mania being suddenly produced by mental shock must be searched for in works of fiction. Sudden fright, more especially, is stated to produce immediate convulsion, epilepsy, and catalepsy, but not insanity; except in certain comparatively rare instances, in which it appears to induce with great rapidity a cataleptic mental state, presently to be spoken of as acute primary dementia. Over-exercise of the intellectual function is not by any means such a prolific cause of brain disease as undue emotion. It is not work but worry that kills the brain. When both are combined the result is often rapid.

On the removal or persistence of congestion depends the issue of a case—recovery, or further and permanent solution of continuity. Unless relief is soon obtained, the changes in the cells are followed by lesions of other brain structures which are productive of important pathological conditions affecting the general system; these in their turn render recovery more difficult or impossible, or may even cause death.

2. The second class comprises all accidents and injuries affecting the brain, and is most conveniently termed *traumatic*. Violence to the head may produce fracture of the skull, with or without depression, extravasation of blood in or on the brain, or concussion. There is no relation between the apparent extent of the injury and the results of insanity; extensive fractures of the frontal, lateral, and superior surfaces of the skull, even when complicated with rupture of the envelopes and loss of brain matter, are not, taken over all, more productive of insanity, if so much so, as the apparently less serious condition of concussion. The reason of this is not far to seek; by the open wound free egress is afforded for extravasated blood and the products of inflammation, whereas in concussion, which may also involve extravasation of blood in or on the brain, foreign substances have no means of escape, and so may set up morbid action of a grave nature. Occasionally insanity follows rapidly on the injury, but much more frequently weeks or even months elapse before development of mental symptoms amounting to insanity. During this period morbid action is proceeding on the inner surface of the skull, in the membranes, or in the brain itself. On the inner table of the skull bony growths may be in process of formation, subacute inflammation of the membranes may be going on, and from the same cause the brain may be undergoing progressive changes generally in the direction of sclerosis, *i.e.*, increase of connective tissue.

3. The nervous diseases in the train of which insanity occasionally follows are Epilepsy, Hysteria, and Locomotor Ataxy. In the case of Epilepsy the brain lesions are doubtless the result of the frequently asphyx-

iated condition of the patient and of the blood poisoning due to the retention of carbonic acid gas. As might be expected, lesions of the arteries in the form of hypertrophy of their coats is frequently observed. The canals in the brain matter through which the vessels pass are very frequently found dilated to from two to six times their normal dimensions. If the richness of the blood supply to the gray matter is considered, this condition of dilatation must imply an immense loss of brain tissue; moreover, the cells are frequently found suffering degeneration. In dealing with the subject of hysteria, we have to do with a disease which, although marked by very prominent symptoms, possesses no anatomical seat, and thus when the disease amounts to insanity we are equally in the dark as to the cerebral conditions. The insanity following or accompanying hysteria is not a fatal one in its earlier stages, and there is no report extant of an autopsy on a recent case of this disease. Locomotor Ataxy is a disease of the spinal cord, sclerosis of its posterior columns. It implicates other parts of the nervous system—for instance, the optic tracts and nerves. Insanity occasionally is concurrent with, and probably, if not certainly, is produced by, an extension of the sclerosis to the cerebral convolutions. This theory meets support from the fact that the mental symptoms associated with locomotor ataxy resemble very closely those of general paralysis, in which hypertrophy of the connective tissue of the superior convolutions has been demonstrated.

4. By the term adventitious products it is meant to indicate all forms of tumors of the brain, skull-cap, and membranes. Such foreign bodies have three distinct effects on the brain structure:—“1st, They create an irritation tending to ramollissement in the nerve substance, with which they are in contact from their first appearance. 2d, They cause pressure on distant parts, which in its turn causes an alteration of the structure and nutrition. 3d, They set up progressive disease and degeneration of certain parts of the nerve structure, the true nature of which is as yet not very well known; but it seems to be in some way directly connected with the essential nature and constitution of all sorts of nerve substance, whether cells or fibers. Its results pathologically are an increase of the connective tissue in the form of granules, and enlargement and thickening of the coats of the blood-vessels; but all these seem to be secondary changes.” Apoplectic clots are practically tumors.

5. Morbid conditions of the general system secondarily implicating the brain. It is of great interest from an etiological point of view to note that insanity is seldom if ever the immediate result of diseases of individual organs, but that it is more or less intimately associated with those forms of disease which result from a general constitutional instability, such as tuberculosis, rheumatism, gout, and syphilis. There are many diseases painful in character and very depressing to the nervous system, such as stone, fistula (in fact all the so-called surgical diseases of the rectum and bladder), cancer of the uterus, etc., which might be presupposed to be probable causes of insanity, yet in point of fact are not inimical to mental health. They may be so indirectly, inasmuch as they prevent sleep, but even in this wise their effect is very slight. Nor does there appear sufficient reason to connect diseases of the heart, liver, kidneys, directly with insanity. Much stress has been laid on diseases of the uterus and ovaries, and more especially on tumors of these organs, being the primary factors in the production of insanity. But authors on gynecology make no mention of insanity being a sequela of uterine disease, except in so far as the mental depression which in most women follows on the knowl-

edge that they are affected by serious, perhaps fatal, disease, and the pain and anxiety inseparable therefrom, may produce sleeplessness, and consequent melancholy; and there is no proof of such tumors exercising an extensive influence on causation by peripheral irritation. The fallacy has in the great majority of instances probably arisen from the observation often made in asylums that insanity arising from whatever cause is conditioned by the presence of uterine growths, and that delusions of a sexual character may arise from the sensations thereby produced. Of the very few instances on record in which a direct connection between uterine disease and insanity has been traced may be cited a case reported by Van der Kolk, in which deep melancholy and prolapsus uteri coëxisted; the mental symptoms were at once relieved by the organ being restored to its normal position. Such cases are very rare. Excessive sexual indulgence is frequently alleged as a cause of insanity in man. Admitting the truth of the position taken, the result is but the product of nerve complications and it is extremely to be doubted that any purely mental (or moral) consideration is to be taken into account. Undoubted cases of insanity arise from unnatural gratification of the sexual appetite (masturbation). Here we have to deal not only with the physical effect of nervous disturbance and depletion of the nutritive elements of the blood, caused by excessive expenditure of the seminal fluid, but also with the mental effect of delusions frequently indulged. To explain our position: During the act of masturbation, the subject invariably as a result of his sexual excitement fixes his mind on some one of the opposite sex, and in his imagination is performing the sexual act with the object of his thoughts. As he approaches the climax of his excitement the delusion becomes more and more vivid. It follows that these delusions being frequently indulged in will acquire more and more intensity until the subject is unable to discriminate between *reality* and *delusions*. Nor does the delusion end with sexual subjects; it gradually extends to other matters, and the victim of self-abuse is unable to discriminate between the real and the imaginary in the common affairs of life—in other words, is insane. Taken *time for time*, we believe that masturbation (save the difference of moral effect) is no more harmful than sexual intercourse. Its great evil is in the frequent opportunities one has for its indulgence—thereby leading to excess.

It is still a moot point whether a true tubercular or phthisical insanity exists; if it does, it certainly does not arise from tubercular deposits in the brain—a very rare condition in the insane. Those authorities who deny the existence of phthisical insanity hold that, although mental symptoms do frequently present themselves in cases of consumption, and although consumption is very frequent among the insane, the insanity is not directly dependent on the diathesis, but more probably results from the general lowering of the system, and at most is only conditioned by the primary disease. In the case of rheumatism and gout there are strong reasons for believing that an actual translation (metastasis) of the *materies morbi* occasionally takes place from affected joints to the connective tissue of the brain and cord—the evidence being choreic movements of the limbs, St. Vitus' Dance) accompanied by acute mental symptoms, both of which disappear contemporaneously with the return of inflammatory swellings of the joints. Syphilis may act on the brain by the production of tumors (which, however, do not differ in their effects from those of other adventitious products), and by specific changes in the coats of the arteries, which become thickened and even occluded. As a consequence the tissues in their neighborhood suffer deterioration.

The pathological relation between sun-stroke (insolation) and brain disease has not been ascertained. A certain amount of brain congestion has been observed, but not invariably. The cerebral lesion is more probably due to the extreme depression of the whole nervous system; but the *modus operandi* is unknown.

The morbid condition of the general system which most frequently implicates the brain is anæmia, not itself a disease, but the result of many diseases, such as fever, and of such drains on the constitution as lactation (suckling) and imperfect nourishment. The operative-ness of these drains may be assisted by overwork under unhealthy conditions. As a typical example may be cited the dressmaker, poorly paid, poorly fed, working for many hours daily in an ill-ventilated room, and sleeping in an unhealthy garret. The term anæmia is not used here to indicate a condition antithetical to hyperæmia—it does not imply any mechanical deprivation of blood supply; on the contrary, the amount of blood, such as it is, is not reduced in quantity. The temporary mechanical anæmia which results from extreme cold produces its effects rapidly—short delirium and profound sleep. But it is qualitative anæmia, an impoverished state of the blood, which produces more or less permanent results on cerebral health. Inanition acts rapidly on the brain: in the case of those cast away at sea on rafts or in boats the general story is that of short delirious mania, suicide, or death from nervous exhaustion, before emaciation (*i.e.*, before the reserve food of the system is consumed) takes place. So in cases where inanition is more slowly produced, the nervous system is first depressed. And here the position becomes somewhat complicated; for not only is, under such circumstances, the relative amount of the blood constituents different from the normal standard, but its corpuscular elements changed in quality; they acquire a degree of viscosity which tends to cause the red corpuscles to coalesce and hang together, and the white to lag and wander into surrounding tissue; and further, this unphysiological behavior of the corpuscles is apt to become aggravated in regions whose nervous energy is depressed. Anæmia thus acts and reacts in procuring a condition of stasis.

6. The effects of evolutionary periods concurrently affecting the brain; puberty, adolescence, utero-gestation, the climacteric period, and old age. Although from the time when the human being comes into the world to the final cessation of his corporeal existence the various functional operations of organic life are carried on with ceaseless activity, while those of animal life are only suspended by the intervals of repose which are needed for the renovation of their organs, yet there are very marked differences, not only in the *degree of their united activity*, but also in the *relative degrees of energy which they severally manifest* at different epochs. These differences in degree imply physiological modifications of nutrition, and the observation of ages has caused it to be accepted as a fact in the etiology of disease that numerous and various degenerations occur contemporaneously with such modifications, more especially in the subjects of diathetic conditions. The development of phthisis during adolescence, and of cancer among persons at the climacteric period, may be cited as instances. It may be freely admitted that the nexus between the physiological and the pathological position is, as regards certain of the periods, obscure, and that it is dependent more on induction than on demonstration; but it may be pleaded that it is not more obscure in respect of insanity than of other diseases. The pathological difficulty obtains mostly in the relation of the earlier evolutionary periods, puberty and adolescence, to insanity; in the others a physiologic-

pathological nexus may be traced; but in regard to the former there is nothing to take hold of except the purely physiological process of development of the sexual function, the expansion of the intellectual powers, and rapid increase of the bulk of the body. Although in thoroughly stable subjects due provision is made for these evolutionary processes, it is not difficult to conceive that in the nervously unstable a considerable risk is run by the brain in consequence of the strain laid on it. Other adjuvant influences may be at work tending to excite the system which will be spoken of when the insanity occurring at these periods is described. Between the adolescent and climacteric periods the constitution of the nervous, as of the other systems, becomes established, and disturbance is not liable to occur, except from some accidental circumstance apart from evolution. In the most healthily constituted individuals the "change of life" expresses itself by some loss of vigor. The nourishing (trophesial) function becomes less active, and either various degrees of wasting occur, or there is a tendency toward restitution in bulk of tissues by a less highly organized material. The most important instance of the latter tendency is fatty degeneration of muscle, to which the muscle of the arterial system is very liable. In the mass of mankind those changes assume no pathological importance; the man or woman of middle life passes into advanced age without serious constitutional disturbance; on the other hand, there may be a breakdown of the system due to climacteric disease of special organs, as, for instance, fatty degeneration of the heart. In all probability the insanity of the climacteric period may be referred to two pathological conditions; it may depend on structural changes in the brain due to fatty degeneration of its arteries and cells, or it may be a secondary result of general systemic disturbance, due to cessation of menstruation in the female, and, possibly, to some analogous modification of the sexual function in men. The senile period brings with it further reduction of formative activity; all the tissues waste, and are liable to fatty and calcareous degeneration. Here again the arteries of the brain are very generally implicated; atheroma in some degree is almost always present, but is by no means always followed by insanity. Whewell retained his faculties to the last, notwithstanding that his cerebral arteries were much diseased. Still this condition must be taken into account in studying the causation of senile insanity, as it necessarily implicates the nutrition of the brain. It must assist in preventing recuperation of the cells; it may in certain instances diminish suddenly the blood supply to a particular area; but the stronger probability is that the senile mental decay lies at the door of senile degeneration of the cells.

The various and profound modifications of the system which attend the periods of utero-gestation, pregnancy, and child-bearing do not leave the nervous centers unaffected. Most women are liable to slight changes of disposition and temper, morbid longings, strange likes and dislikes during pregnancy, more especially during the earlier months; but these are universally accepted as accompaniments of the condition not involving any doubt as to sanity. But there are various factors at work in the system during pregnancy which have grave influence on the nervous system, more especially in those hereditarily predisposed, and in those gravid for the first time. There is modification of direction of the blood toward a new focus, and its quality is changed, as is shown by an increase of fibrin and water and a decrease of albumen. How much these changes structurally affect the encephalon may be deduced from the fact of the presence of bony plates (osteophyte) on the surface of the dura mater and the

inner table of the skull, and how much functionally, by constant congestions and flushings. To such physical influences are superadded the discomfort and uneasiness of the situation, mental anxiety and anticipation of danger, and in the unmarried the horror of disgrace. In the puerperal (recently delivered) woman there are to be taken into pathological account the various depressing influences of child-bed, its various accidents reducing vitality, the sudden return to ordinary physiological conditions, the cessation of the occasional physiological condition, the rapid call for a new focus of nutrition, the translation, as it were, of the blood supply from the uterus of the *mammæ*—all physical influences liable to affect the brain. These influences may act independently of moral shock; but, where this is coincident, there is a condition of the nervous system unprepared to resist, or, it may rather be said, prepared to succumb.

7. Among the toxic agents which affect the brain, alcohol holds the foremost place. On the action of this poison the article DRUNKENNESS supplies full information. Considerable difficulty exists as to the estimation of the importance to be attached to alcohol in the production of brain disease from the fact that excess in the use of stimulants is very frequently a symptom of incipient insanity, and that the symptom is often mistaken for the cause. The habitual use of opium and Indian hemp (*Cannabis indica*), which first stimulate and then paralyze the action of the cerebral cells, is a frequent cause of lesion.

Difficulties may arise in individual cases in establishing a theory of causation from the presence of what are generally spoken of in systematic works on insanity as "mixed" causes, *i.e.*, the presence of two morbid factors in one individual. So long as these consist in variety in character of excited psychical action, such as grief and anxiety of business, over-prolonged study and domestic affliction, the combination does not affect the position; but when we have the history of one or more such psychical influences being associated with a depraved condition of the general system, with poverty, with excess in alcoholic stimulants, or with hereditary predisposition, it appears at the first glance difficult to assess the value to be attached to each in the production of brain disease. This complication is, however, more apparent than real; weakness of the system, whether produced by disease or by malnutrition, only implies a condition in which cerebral degeneration is more likely to occur, but where there is no reason to believe it would have occurred if the brain, weakened along with the other organs of the body, had not been subjected to over-excitation. It may be argued that the brain excitation would not have produced the lesion if the tone of the general system had not been lowered; that is as may be—it is a proposition which cannot be accepted or denied positively in the absence of positive data. But negative data obtain which warrant its refusal. These are twofold:—a depraved condition of the general system is a frequent result of over-excitation of the brain, the result being liable to be mistaken for the efficient cause; and the history and symptoms of insanity resulting from special morbid conditions of the system differ materially from those produced by over-excitation.

The action of all these varied morbid factors is in the direction of solution of continuity of cerebral elements, and consequently of perversion of psychical function. And here a wide gap opens itself in the study of brain pathology in its relation to morbid psychology. No adequate theory has been advanced to account for the sequence of a particular type or train of morbid mental symptoms on a particular morbid condition of the brain. In the most definite forms of insanity, those of

which the morbid anatomy is pretty definitely determined, there is not the slightest suggestion afforded of the causation of the peculiar type of mental symptoms which symptomatize them, or for the alternation of symptoms in an individual case, or for diversity of symptoms apparently starting from the same cause. All that is known is that when the hemispherical ganglia are diseased we may have excitement or depression of feeling, delusion, or obfuscation of the intellectual and moral qualities; but why in one case excitement, in another delusion, and in a third both, is an utter mystery.

Classification.

The mental symptoms of acquired insanity have been classified from the time of Pinel—it might, save from some slight difference in the application of the terms, be said from the time of Hippocrates—as mania, melancholia, and dementia, according as exaltation or depression of feeling or weakness of intellect presents itself most prominently in a given case. Pritchard asserted that mental symptoms were divisible into two great classes, according as the intellectual and moral faculties were implicated. This principle falls to the ground from the simple but most important fact, that the primary symptom in all insanities is perversion of the moral sense, and that this perversion pervades all cases of mental disease to their termination. This change of morale amounts to various degrees of perversion of the ordinary character and disposition of the individual. He becomes indifferent to social considerations, apathetic and neglectful of the personal and family duties, evinces dislike and suspicion of friends and relatives, and may betake himself to excess in alcoholic stimulants and other forms of dissipation. There is a general concentration of his ideas on himself, which is often spoken of as the selfishness of the insane. According to the direction in action in which perversion of the moral sense is manifested such so-called forms of insanity have been constructed as dipsomania, kleptomania, erotomania, etc., which, however, are to be regarded as merely accidental phenomena. Moral insanity may appear to exist alone at certain times in certain cases, but it is greatly to be doubted, whether it really ever exists apart from intellectual perversion. The mere fact that a person cannot appreciate the change in himself, cannot, as it were, disapprove of his own actions, is evidence that the moral faculties are not alone implicated. The converse proposition may be stated even more strongly—intellectual insanity never exists without moral perversion.

Moral perversion is, however, only one of the initial symptoms. In most insanities a “period of incubation” is observed, generally spoken of as the prodromal or initial period. Sudden and violent outbursts of insanity are occasionally reported, but, when these are carefully examined into, a train of prodromal symptoms, physical as well as psychical, can almost invariably be traced. These symptoms are for the most part insidious in character. Founding on the statements of patients suffering from premonitory symptoms, on those made by others, who, having recovered, are able to carry back their recollection to the incidence of the prodromal stage, and on the direct observation of the physician, physical indications are the first to present themselves. These consist in a feeling of fullness in the head, throbbing of the forehead and eyeballs, flashes of light before the eyes, and general malaise. The mental symptoms follow closely, and consist, in addition to the change in morale already spoken of, in restlessness, irritability, inability to apply the mind to the everyday affairs of life, and sleeplessness. In certain forms this description of the prodromal symptoms requires some

slight modification. They are very generally accompanied by impairment of general health.

When Esquirol's definition of the mental conditions is quoted, little more need be added, for further description would merely involve an amplified account of psychological peculiarities. Esquirol thus describes the conditions:—(1) Melancholia, or, as he terms it, Lypemania, disorder of the faculties with respect to one or a small number of objects, with predominance of a sorrowful and depressing passion; (2) Monomania, in which the disorder of the faculties is limited to one or a small number of objects, with excitement, and predominance of a gay and expansive passion; (3) Mania, in which the insanity extends to all kinds of objects, and is accompanied by excitement; (4) Dementia, in which the insensate utter folly, because the organs of thought have lost their energy and the strength requisite for their functions. In 1852 Schroeder van der Kolk and in 1860 Morel laid the foundation of a classification more in accordance with pathological science. The former included the different forms of the disease under two great classes:—“idiopathic insanity,” comprising all cases produced by primary affections of the brain; and “sympathetic insanity,” including those due to morbid conditions of the general system. Morel divided the insanities into six groups:—(1) hereditary insanity; (2) toxic insanity; (3) insanity produced by the transformation of other diseases; (4) idiopathic insanity; (5) sympathetic insanity; (6) dementia, a terminative stage. Notwithstanding faults of detail, it may be fairly said that these propositions marked a great advance in the study of insanity, and that all later classifications based on the same principles have been derived from study of them. The following system admittedly is so:

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| I. Idiopathic insanities. | { Idiopathic mania, melancholia, and dementia.
General paralysis of the insane. |
| II. Traumatic insanity. | |
| III. The insanities associated with other neuroses. | { Epileptic insanity.
Hysterical insanity.
Hypochondriacal insanity. |
| IV. Insanity resulting from the presence of adventitious products. | |
| V. Insanities resulting from morbid conditions of the general system. | { Phthisical insanity.
Rheumatic insanity.
Gouty insanity.
Syphilitic insanity.
Insanity from sunstroke.
Anæmic insanity. |
| VI. Insanities occurring at evolutionary periods. | { Insanity of pubescence and adolescence.
Climacteric insanity.
Senile insanity.
Insanity of pregnancy.
Puerperal insanity. |
| VII. Toxic insanity. | |

I. IDIOPATHIC MANIA AND MELANCHOLIA.—It is proposed to consider under the head of Idiopathic mania and melancholia the large and important class of cases which result from over-excitation of the brain, due to so-called moral causes. In considering this form of insanity, a difficulty arises in reconciling the dependence of two such apparently widely divergent morbid psychical states as mania and melancholia on one common pathological condition. That they are so is maintained by the following clinical observation: 1st, that during the prodromal period, *i.e.*, the period during which over-excitation is using its influence on the brain tissues, the symptoms of excitement and depression generally alternate; 2d, that in certain acute cases mania and melancholia coexist, that is to say, it is impossible for the observer to say whether they are cases of maniacal melancholia or melancholic mania; 3d, that, as many cases run their course toward recovery, the symptoms are consecutively mania, melancholia, and dementia; 4th, that the effects of irritating poisons applied to the brain, alcohol markedly, produce these symptoms in some individuals in a very short space of time. These observations point, not to a difference of pathological causation, but to variation in symptoms in conformity with the progress of pathological processes. It must be borne in mind that congestion is

not a condition constant in quality or in quantity, and, further, that it is an inconstant condition acting on an inconstant subject, and therefore productive of cumulative, inconstant results. Brain congestion, due to over-excitation, produces functional excitement of that organ. It must be remembered that although mania is accompanied by exaltation, and melancholia by depression of feeling, they are both manifestations of excitement of feeling. Given this common psychological condition of excitement, a reason must be sought for the variety of its manifestation either in some peculiarity of the irritating cause or in some idiosyncrasy of the affected individual. In either case no material assistance is gained from psychological considerations, for there is no necessary connection between depressing emotions and melancholia; intense grief often produces acute mania, and the insanity of the man of saturnine mind is as often as not characterized by mania. The peculiarity of the irritating cause appears to be, not its psychological characteristic, but its intensity. The more rapidly excitement of feeling is produced, the more likely is mania to be the symptom of the insanity. That melancholia often supervenes on depressing emotions gradual in their incidence does not imply a psychological nexus, but that, as their irritating influence is slowly applied, so the results of the irritation are slowly produced, and (as in the case of every tissue of the body) there is variety of degree of symptoms in conformity with the rapidity of the progress of pathological events. There are also various underlying conditions difficult to treat of in the mass, any one of which may have considerable bearing on an individual case. Constitutional predisposition (diathesis) may render a person more prone to the sub-acute forms of disease, and the condition of the body at the time of irritation may influence the nature of the symptoms in either direction. In the absence of the possibility of applying to the brain the mechanical aids which have given the physician an insight into the sequence of pathological events occurring in other organs, the pathologist has nothing to depend on save clinical observation. He has presented to him a diseased organ, complex in function, of the physiology of which he is, as regards its psychical action, profoundly ignorant; all he can say is that, when its histological integrity is impaired, he has reason to believe that "some functions become torpid and oppressed, while others are excited into preternatural activity" (Bucknill and Tuke). It must be stated, however, that in a considerable proportion of cases the nature of the ultimate condition is foreshadowed from the very commencement by the character of the initial symptoms. Simple depression of feeling may be the first and last symptom of insanity, or it may gradually increase in intensity till it attains the extreme and most complicated form of melancholia. In like manner simple excitement and exaltation of feeling may characterize a case from beginning to end, or it may culminate more or less rapidly in active mania, without the intervention of other psychical symptoms.

As to the duration of the prodromal period, in the mass of cases nothing can be stated with certainty; it can only be said that, as a general rule, the incidence of melancholia is more slow than that of mania. Putting aside exceptional cases, it may be stated that, whereas the former is a matter of months or weeks, the latter is a matter of weeks or days.

The initial mental symptoms having been already described, it remains only to say that the general system becomes coincidentally affected; functional disturbances of the digestive organs soon manifest themselves, and the nutrition of the body becomes defective. To this implication of other systems consequent on impairment of the trophesial (nourishment-regulating) function of the brain can be traced a large amount of the errors which exist as to the causation of idiopathic melancholia and mania. Very frequently this secondary condition is set down as the primary cause; the insanity is referred to derangements of the stomach or bowels, when in fact these are, concomitantly with the mental disturbance, results of the cerebral mischief. Doubtless these functional derangements exercise considerable influence on the progress of the case by assisting to deprave the general economy, and by producing depressing sensations in the region of the stomach. To them may probably be attributed, together with the apprehension of impending insanity, that phase of the disease spoken of by the older writers as the *stadium melancholicum*, which so frequently presents itself in incipient idiopathic cases.

During the earlier stages of the prodromal period it is impossible, in the majority of cases, for the physician to predict, with anything like certainty, whether the case may culminate in acute melancholia or acute mania. But as it progresses the irritability and restlessness which ushered in the malady become intensified; sleep is either irregular or may be lost for nights together; further degeneration of the brain constituents necessarily follows, and the loss of controlling power over ideas is manifested in excitement in one of two ways—(1) by the domination of one set of ideas, which are for the most part of a depressed character, or (2) by a tendency to follow lines of thought suggested by accidental external circumstances. Although in the one case there is a concentration and in the other a diffusion of ideas, there is the common result of occlusion of the individual from a normal

process of thought, in consequence of his inability to review external circumstances correctly.

1. *Acute Idiopathic Melancholia* presents itself in three degrees of intensity:—(1) simple depression of feeling, (2) depression of feeling with delusion, (3) depression of feeling with mania or delirium. The second and third of these conditions may supervene on the first, or any one of them may singly characterize the case.

Simple Depression of Feeling.—In no form of insanity is the sane mind more prone to project a psychological scheme of causation than in that of which simple depression of feeling is the predominant symptom. The restlessness and irritability which accompany anxiety, grief, and worry, and the consequent exhaustion and depression, suggest a psychological continuity. There is, however, a very distinct difference between depression of feeling within the limits of health and the depression of feeling resulting from morbid processes going on in the brain, and in symptoms there is a distinct line of demarcation. A mere fit of depression, from whatever cause, does not prevent a man from using his intellectual faculties; circumstances influence him, and he can review his position; but where the limit of health is passed the normal influence of external circumstances is lost. This indication is accompanied by a gloomy apathy; the memory of the past is misery, the present is unendurable, and there is no hope in the future; everything is black within and without, every incident feeds the melancholy, every suggestion of hope is parried, and every appeal to the reason falls dead on the ear of the sufferer. This latter symptom—the inoperativeness of appeals to the reason—is a feature of all forms of insanity, and it is therefore well to notice it particularly when treating of the simplest. What to the sane mind is the simplest proposition, to the insane appears either utterly false in itself, or to have no bearing on the position. The power of comparing idea with idea, the faculty of discriminating their differences, or the perception of agreement in the midst of difference is lost—in a word, the judgment is impaired or utterly in abeyance. The common everyday expression "out of his judgment," employed to indicate that a man is insane, is psychologically accurate, and logically applicable in all forms of insanity. A strong tendency to suicide frequently presents itself; the utmost ingenuity is exercised to accomplish this object, the whole mental energies being concentrated upon it. It is impossible to render in terms the general as well as facial expression of the melancholic; it cannot be simulated with success before anyone conversant with the condition.

Depression of Feeling with Delusion.—Idiopathic melancholia symptomatized by simple depression of feeling may become gradually complicated with delusion and hallucination, or this complicated condition may follow immediately on the initial symptoms. The delusions and hallucinations of idiopathic melancholia may be divided into three classes—(1) those traceable to perverted sensation produced by implication of the functions of the general system; (2) those apparently dependent on the nature of the primary causating train of emotion; and (3) those which it is impossible to connect with any particular influence, either psychical or somatic. The first class contains the delusional symptoms resultant on atony of the alimentary canal, which, by producing obstinate constipation, catarrhal affections of the stomach and bowels, and dyspepsia, cause sensations which are referred by the insane mind to supernatural influences—he believes that he has serpents or worms inside him, that his gullet is closed, or that his bowels are so obstructed as to render relief by the natural passage impossible. As a direct result of this delusion food is systematically refused, and it often becomes necessary to resort to artificial feeding by the stomach-pump or some allied apparatus. Hallucinations and illusions of smell and taste may be referred to the same causes as the delusions just spoken of—the fetor of the breath due to dyspepsia may suggest to the melancholic that he is surrounded by a poisonous atmosphere, and that everything near him stinks; and the foul tongue of the same condition may be productive of hallucinations of taste, and may even lead up to the very common delusion that his food is poisoned. Such distinct objective starting points, however, do not suggest themselves for hallucinations of vision and hearing; these can only be regarded as incidental results of the morbid cerebral condition of which the process of production is unknown. Hallucinations of sight are comparatively rare; when they do occur it is generally in the form of specters, which prompt to suicide, self-mutilation, or homicide. Hallucinations of hearing are more common, and are believed to be of graver import. As a rule the hallucination takes the form of words emanating from a something or someone of whose personality the patient has no conception. That an apparent connection can often be traced between the character of the delusion and that of the primary causating emotion is particularly true of the melancholic delusions which follow on religious emotionalism, so much so that many writers regard religious melancholia as a distinct form of insanity. This is a term, however, very loosely employed, and it is, in fact, by no means easy to ascertain what it implies; by one section of authors it is regarded as that form of melancholia in which the insanity centers upon religious

ideas, by another as the form of insanity produced by depressing religious emotion. The latter position is tenable on purely clinical considerations, if the insanity retains the character of the causating emotion, which it very frequently does not; the former is open to the objection that the delusions may be mere accidents in a case, and may bear no relation whatever to the exciting psychical cause. One reason why the term is so strongly impressed on the mind of the public is, that it may appear as pseudo-epidemic. The waves of religious emotionalism, which almost periodically disturb society in the form of "revivals," are apt to produce explosion of psychical action in those members of the community predisposed to nervous degradation. The public never considers, in fact does not know, that any other equally potent cause of emotion might be as effectual, and therefore sets down such accidental congeries of cases as "religious melancholia," accepting that term as representing all the abnormal psychical conditions which may result from "revivals." It is better to consider religious influences in the common category of emotions producing over-excitation of the brain. The deep despondency which follows on religious emotionalism may be productive of such predominating ideas as that the soul is irretrievably lost, that the unpardonable sin has been committed, and that there is no hope of salvation. Although in the abstract it is open to question whether such predominating ideas are strictly delusions, inasmuch as they may be considered as morbid exacerbations of fears and anxieties suggested by certain schools of religious thought, still in the concrete they amount to delusion; for, even supposing they have been arrived at by a normal process of reasoning—which in most cases is extremely doubtful—they are maintained at the expense of all other religious considerations, and by the exclusion of all arguments founded on the experience of others.

The delusions which it is impossible to connect with any particular physical or psychical influence are for the most part characterized by suspicion and fear, and take such forms in the mind of the patient as that spies surround him, that all his actions are watched, that all connected with him are plotting against him, that conspiracies are being organized with a view to deprive him of his estate, procure his ruin, or do him some evil of which he can give no definite explanation. Occasionally delusions of fear and suspicion are connected with persons whom the patient has never seen, or with sections of society, such as political parties or religious communions. Self-accusation of serious crimes is a frequent result of delusion. This idea of crime may be entirely unsubstantial, or it may possess some very slight foundation in fact, one which has no rational bearing on the existing position. When insane self-accusations are critically examined, it is found that remorse is very rarely connected with the real or imaginary crimes, from the consequences of which others have or might have suffered. The poetic stories of insanity produced by remorse of conscience for crimes involving the ruin or disgrace of others than the actual offenders may be set down as in the main apocryphal.

The delusions of the melancholic are often fearfully intense, and produce very serious results in action; they are apt to extend beyond himself. By a process of reasoning which the sane mind cannot appreciate, he may argue himself into the belief that his misery is also the misery of his friends and family, that his relatives are cognizant of or implicated in his imaginary crimes, and that they must suffer the consequences along with him. As death offers to him the only chance of relief, so he believes it best that those nearest and dearest to him should die also. From this state of feeling follow those fearful acts of homicide which occasionally startle society—a parent destroys several of his children, a lover his mistress, or a husband his wife, before committing self-destruction. It is as well to attract attention here to the appearance of a tendency to homicide and suicide as an incident in a case, as the subject will have to be recurred to when adverting to the question of homicidal and suicidal insanity.

Depression of Feeling Associated with Delirium or Mania.—In this class of cases it is impossible to say whether they should be called melancholic mania or maniacal melancholia. The wildest delirious excitement coexists with the deepest depression of feeling; delusions of fear and horror are given expression to in the most extravagant manner, and relief from them is sought in frantic attempts at suicide; the patient dashes his head against the floor or wall, tries to cast himself down-stairs, holds his breath in the hope that he may suffocate. In this condition there is a strong tendency toward death, which not infrequently occurs within a few days of the development of the graver symptoms, and which is generally produced by congestion of the lungs as a direct result of the cerebral condition, *i.e.*, by a true cerebral pneumonia.

2. *Acute Idiopathic Mania* presents itself in three forms:—(1) simple exaltation of feeling, (2) exaltation of feeling with delusion, (3) acute delirious mania. The second and third of these psychical conditions may supervene on the first, or any one of them may singly characterize a case; in all, the period of transition from the prodromal stage is much more rapid than in acute idiopathic melancholia.

Simple exaltation of feeling manifests itself in all degrees

of intensity between mild general excitement and the extreme forms of maniacal furor; in kind it may not amount to more than a decided increase of the initial symptoms of restlessness, irritability, and change of disposition; in degree it is characterized by greater or less excitement of thought, word, and action. The general vague restlessness and irritability of the prodromal period not only become exacerbated, but manifest a tendency to produce results in action. Excited action may show itself either in a general exaltation or in the suspension of normal trains of thought. A prominent example of the first psychical condition is found in the naturally devout mind under certain conditions of excitement: the habitually religious man may have meditated on schemes for self-conduct, the good of mankind, or the spread of religion, schemes which, so long as mental action was under control, were mere projects, things to be hoped for, but which under morbid excitement assert themselves so powerfully as to be regarded by the unbalanced mind as immediate necessities, to be procured at the expense of all considerations. The real distinction of religious mania from religious enthusiastic excitement consists, not in the form of the ideas for which parallel cases might be found in sanity and insanity, but in the *per saltum* manner in which it is sought to carry them into action, in the leaving out of those links which the sane mind uses to decide on the adoption or rejection of a scheme, but the omission of which transfers the scheme suddenly from the region of imagination and hope to one of present reality. There is an absence of religious totality; the patient is bound up in some scheme for the advancement of religious knowledge, in some project for the building of a church, the founding of a school, the establishing of a mission, or, more probably, for all at once; for this he neglects his family, all social considerations, and those duties which are the precepts of his faith. Whether the apparently efficient cause be religion, politics, or the prominent social question of the day, the results are identical, being only conditioned by the nature of the original idea. The ordinary behavior of the man is changed; he is ever on the move; his gestures, loud tone of voice, volubility of talk, and general manner are such as to cause his friends distinctly to mark the change. A large proportion of such cases recover under appropriate treatment, but they not infrequently pass into acute delirious mania. When the disease is manifested by the suspension of the ordinary trains of thought, the symptoms consist, for the most part, in recklessness of action and conversation; there is a sort of exalted joyousness, a strong tendency to dissipation, loud and wild though not necessarily incoherent talk, extreme restlessness, and utter want of respect for all conventionalities. Such patients (reputable members of society, be it remembered, a month or a week before) outrage all sense of decency; they may walk the streets with strumpets, and appear drunk in public, forcing their behavior on the notice of the police. They care nothing for the feelings of friends or the prospects of their families. The intellectual faculties may be active; thus wit and humor, uncontrolled by any feelings of consideration for others, may stand out all the more prominently. The condition, taken over all, is very closely allied to that stage of intoxication in which the poison of alcohol sets free all controlling influences. When the restraining power of association is lost, there is no difficulty in comprehending that the uncontrolled brain may act in any direction. This class of cases is specially emphasized, because they are apt to be mistaken by the public for instances of mere moral obliquity.

The relation of amount of mental disturbance to the degree of excitement is not definable; mania may be extreme, and the disturbance of ideas apparently slight, and *vice versa*. It is of great importance that the two following facts should be insisted on:—(1) that mania of an extreme description can exist without delusion; and (2) that mania of a dangerous nature may exist without furious excitement. It is in this class of mania that cases of so-called *folie raisonnée* are for the most part met with—a class strongly insisted on by many Continental authorities as of great pathological importance. By one section of foreign writers it is spoken of as *folie raisonnée*, by another under the original name suggested by Pinel *mania sine delirio*, while by a third both are used promiscuously to indicate a class of cases in which, although considerable disturbance and excitement may exist, the sufferer is able to justify his course of action by a line of reasoning not illogical in itself, although founded on false premises.

Exaltation of feeling with delusion or delusional mania, whether it follows on a period of simple exaltation of feeling, or is coexistent with the first symptoms of excitement, is not to be connected with the originating psychical cause; indeed the intellectual confusion is so great and of such a kind as to render any analysis impossible. It is well to mark here the psychological difference between maniacal and melancholic delusions; the latter are persistent in character and appear to proceed from within, the former are changeable and are readily acted on from without. The general expansiveness of ideas, the rapidity with which they are produced and influenced by external objects, along with the inability to correlate idea with idea, are productive of incoherence in thought, word, and action. For instance,

a man may imagine and state that he is the king of the universe, at the same time that he enters no remonstrance against herding and eating with his fellow paupers; he may assert his superiority, but may not object to obey the behests of a common keeper.

Acute delirious mania is a condition often rapidly produced and not infrequently fatal. It may be the culmination of a case which has passed through the stages of simple exaltation of feeling and mania with delusion—the latter rarely; or it may appear in a few days or even a few hours as the result of some severe mental shock. It may persist for only a short time, and is then spoken of as acute transitory mania. The symptoms are very definite—the wildest yells and screams, a frenzied rushing to and fro, a reckless casting of the body on the ground or against the walls and furniture, smashing everything that comes in the way without any definite purpose save smashing, flushed features, clammy sweat, and a high bounding rapid pulse; nothing can control the patient but physical force, for his fury renders him blind to all influences.

3. *Acute Primary Dementia*.—This disease is of rapid incidence. It may result from sudden psychical disturbance, especially fright; occasionally no cause can be traced. After a few days or hours, during which the patient is somewhat stupid and apathetic, these symptoms increase to such a degree as to cause him to be, to all outward appearance, utterly demented; he sits unaffected by anything that goes on around him; he is completely helpless, cannot take off or put on his clothes nor feed himself, and passes urine and feces where he sits or stands; he is speechless, and cannot be roused to action by any appeal; his movements are slow, when he can be got to move at all; but the chief motor symptom is a degree of catalepsy. It may be said with truth that the condition is one of mental and bodily catalepsy. Such cases to the ordinary observer appear utterly hopeless. There is a strong tendency toward death; but, when this is overcome, it often happens that the sufferer gradually emerges from the condition, and can give an account of the sensations experienced during his illness. It may terminate in dementia of a very low type. Post-mortem examination of recent cases frequently reveals dropsy of the brain, or changes in interstitial tissues producing pressure. (See Blandford, *Insanity and its Treatment*; Bucknill and Tuke, *Psychological Medicine*; Griesinger, *On Mental Diseases*.)

General Paralysis of the Insane.—General paresis, progressive paralytic dementia, or, as it is more frequently spoken of, *general paralysis*, is a disease of the superior and lateral convolutions of the brain, which gradually extends over the whole nervous system, producing a peculiar impairment of motor power and invariably accompanied by insanity. It is marked by well-defined series of physical and psychical symptoms, and terminates in a peculiar manner within a definite period.

General paralysis was first recognized as a special disease in France; it was indicated by Esquirol, and its history was fairly elucidated by Bayle, Delaye, and Calmeil, the latter giving it the name of *paralysie generale des alienes*. General paralysis is a common disease, and is generally spoken of as "softening of the brain," a term diametrically opposed to its pathological anatomy. The condition is essentially a chronic diffuse subinflammatory overgrowth of the connective tissue of the cerebral hemispheres, leading to destruction of the true nerve elements, and principally affecting that region of the brain in which recent observers have localized the cortical motor centers. General paralysis is said to be a disease of middle life; this is to a certain extent true, for, in the large majority of cases, its incidence occurs between the ages of thirty-five and fifty; it is, however, met with prior to the first-mentioned age, less frequently after the latter period of life. Statistics show that the decade between forty and fifty is the one during which the disease is most likely to occur. Men are more subject to it than women, in the proportion of, at least, eight to one; in women the symptoms are less strongly pronounced, and the disease runs its course more slowly. Although the relative frequency of the disease appears to be equal in the higher and lower classes of society, statistics show that the town artisan is more liable to it than the agricultural laborer. In the lower grades of society general paralysis is much more common in England than in Scotland or Ireland; in certain English asylums general paralytics constitute from a sixth to an eighth of the inmates, while in Scotch and Irish district asylums the proportion does not amount to more than 2 or 3 per cent.

The progressive character of the disease is marked by three stages, termed the prodromal, the acute, and the terminative. The *prodromal stage* is marked by a somewhat incongruous congeries of mental symptoms, consisting of total change in the habits and disposition, general restlessness and irritability, impairment of memory, extravagance in thought and action, and a peculiar facility closely followed by, or intercurrent with, the bodily symptoms of impaired mobility of the face and tongue. For the purposes of diagnosis the physical are more important than the mental phenomena. As a rule the *bouleversement* of disposition is peculiarly well marked; the impairment of memory consists, not only in the blurring and confusion of past events,

but in the forgetting of the occurrence of one minute in the next—purposes formed and intentions expressed are forgotten almost as soon as formed and expressed. This want of fixity is also shown by the non-recognition of the lapse of time, and by the manner in which violent passion is suddenly changed into amiability. To the same cause may probably be traced the peculiar facility of disposition of the general paralytic; even at this early stage there are indications of the optimism which, as the case progresses, affords the characteristic psychical symptom. In the prodromal period it is manifested by a degree of morbid vanity, general exaltation, and a tendency to regard all things in the brightest possible light. The physical symptoms consist in a finely fibrillar action of the muscles of the tongue, twitching of the upper lip, hesitancy of speech, and a loss of facial expression; the tongue symptom consists of a rapid agitation of its surface, the voluntary movements of the whole organ not being entirely under control, e.g., it is protruded with a jerk; the upper lip hangs and trembles before utterance like that of one struggling against weeping; the hesitancy of speech can best be illustrated by saying that it is identical with the slurring of words in the first stage of intoxication—the patient "speaks thick;" the face assumes a mask-like want of expression—the muscular power being impaired to such a degree as to cause change of expression to be a comparatively slow process. As the disease advances there is greater excitability, and the general exaltation of ideas becomes so great as to lead the patient to the commission of insanely extravagant actions, such as purchases of large numbers of useless articles, or of lands and houses far beyond his means, numerous indiscriminate proposals of marriage, the suggestion of utterly absurd commercial schemes, or attempts at feats utterly beyond his physical powers. Not infrequently he is found committing theftuous acts. The *acute period* is frequently ushered in by maniacal symptoms which generally assume the type of what is termed by French writers *delire ambitieux*. Delusion of the wildest character may now present itself; the patient may believe himself to be in possession of millions of money, to be unsurpassed in strength and agility, to be a great and overruling genius, and the recipient of the highest honors. Every idea is expanded and exalted, whether it relates to time, space or personal attributes. Although grandiose and extravagant delusion is very frequent, existing as it does in about one-half of all cases, it is by no means such a persistent symptom as the *bien etre*, which condition is the diagnostic of the disease in that it is invariably present. This is shown by perfect contentment with himself and all things around him, by the constant use of superlatives and such expressions as "all right," "splendid," "first rate;" he speaks of his health as robust, "never better in my life," even when there is grave constitutional disturbance; he is unaffected by the death of child, or wife, or nearest friend. He is utterly unsuspecting, lost to all appreciation of social relations, and facile in the extreme. Synchronously with this condition, the physical symptoms become exacerbated; the tongue and facial symptoms already spoken of increase in intensity, and in addition impairments of the motor powers of the extremities present themselves, consisting in a loss of co-ordinating power, not in a loss of muscular strength. Thus the gait becomes straddled and uncertain; there is a widening of the basis of support; he has to pick his steps as he goes up and down stairs, and is apt to trip over small obstacles; the action of walking resembles that of a half-drunk man. Later on the arms become involved. The pupils are often irregular. The third or *terminative stage* is marked by "epileptiform" or more properly apoplectiform attacks, the general condition becoming more and more degraded. By this time the patient is almost bedridden; actual palsy often occurs. Toward the end certain of the semivoluntary muscles are affected; bed-sores may form; and he may die slowly of exhaustion or suddenly during an apoplectiform attack. General paralysis runs its course in from one to four years; more rapid and more protracted cases are on record, but, taken over all, eighteen months may be stated as its average duration. The disease is incurable.

II. TRAUMATIC INSANITY.—Generally speaking, insanity is not developed for some months or even years after receipt of the injury, but in the interval the patient suffers from headache, more especially after mental effort, irascibility of temper, confusion of thought, and consequent inaptitude for business, weakened memory, and a constant feeling of fatigue. If this condition is not overcome, a progressive dementia sets in, of which the special character is violence of temper, and a tendency to impulsive action. This dementia is generally complicated with maniacal attacks intervening at uncertain periods and marked by furor or violence. Dipsomania or insane drinking is a not very uncommon result, apart from all other indications of aberration. Prognosis is unfavorable.

III. INSANITY ASSOCIATED WITH OTHER NEUROSES.—*Epileptic Insanity*.—In the intervals between the fits the patient is generally stupid and dull of apprehension. Immediately before or after fits, or, as some believe, occasionally taking their place, mania of a violent and furious, of a subacute, or of an ecstatic character presents itself. All authorities recognize epileptic insanity as the form most dangerous to the public. Prognosis is

unfavorable. *Hysterical Insanity*.—The symptoms described in the article HYSTERIA may become so exacerbated as to amount to insanity. Superadded to these may be delusions of a sexual nature. The most extreme form of mental disturbance supervening on hysteria is acute mania of a very violent character; it is generally of a delirious nature, but does not usually continue for any great length of time. It is open to question whether the "fasting girls" and women with "stigmata" should not be included among the hysterically insane. Men, although very rarely, are liable to this form of insanity. In a sense the prognosis is favorable, inasmuch as prolonged treatment procures great abatement of symptoms, if not actual recovery. *Insanity occurring with locomotor ataxy* strongly resembles general paralysis. Taken over all, it may be stated that the symptoms differ more in degree than in kind, not being so intense. There is not the same extravagance of delusion or violence of mania.

IV. INSANITY FROM THE PRESENCE OF ADVENTITIOUS PRODUCTS is marked by progressive dementia of a dull, heavy character and the absence of delusion. Prognosis is unfavorable.

V. INSANITIES ASSOCIATED WITH MORBID CONDITIONS OF THE GENERAL SYSTEM.—*Phthisical insanity* is stated to be characterized by a short period of mania, melancholia, or delusion, which soon passes into a mixture of subacute mania and dementia. The symptom, according to Clouston, is a tendency to be suspicious. (Consult Clouston, "Tuberculosis and Insanity," *Journ. of Mental Science*, April, 1863.) *Rheumatic insanity* is characterized by hallucinations of sight, touch, and taste, loss of memory, acute delirium succeeded by confusion of ideas and sluggishness of mind, accompanied by choreic movements of the limbs, deadening of reflex action, and even paralysis. These symptoms appear as the articular affection diminishes or disappears; they are, as it were, one vicarious of the other. Prognosis is favorable. (See Griesinger *On Mental Diseases*, p. 189; Clouston, *Journ. of Mental Science*, July, 1870; Sibson, in Reynolds' *System of Medicine*, vol. iv. p. 286.) In *gouty insanity* the alternation of the joint and head symptoms is also well marked. The latter are general mania with delusions of suspicion. Prognosis favorable. (*Vide* Berthier, *Annales Médico-Psychologiques*, 1869. Sydenham also alludes to the condition.) *Syphilitic insanity* frequently commences with acutely maniacal symptoms, shortly followed by hypochondriasis of marked character, paralysis of energy, and rapid progressive dementia. Extravagant delusions often present themselves so strongly as to render the diagnosis between this condition and general paralysis difficult. Prognosis unfavorable. (The most important paper on this form of insanity is by Mickle, *Brit. and For. Medico-Chirurgical Review*, July and October, 1876.) In *anæmic insanity*, however produced, the general train of symptoms is violent mania of short continuance followed by melancholic dementia. Prognosis favorable.

VI. INSANITIES OCCURRING AT EVOLUTIONAL PERIODS OF LIFE.—*Insanity of pubescence and adolescence* is manifested by various trains of symptoms. Acute mania is on the whole the most common—it is characterized by motor restlessness; the patient walks, talks, smokes, drinks, must ever be on the move. Where self-abuse comes in as a factor, the sufferer is melancholic and suspicious, self-accusing. Dipsomania is a not infrequent symptom. But whatever may be the general symptoms of these three sets of patients, they have one common symptom, a perversion or increase of the sexual instinct. Prognosis is favorable as regards the attack present, unfavorable as to the probability of recurrence. *Climacteric insanity*, which is nearly as common in men as in women, is marked by pretty constant symptoms of a melancholic character. Prognosis generally favorable. *Senile insanity* is symptomatized by dementia with frequent intercurrent attacks of mania. Prognosis unfavorable. The most frequent symptoms of the *insanity of pregnancy* are melancholy and moral perversion, the latter taking the form of dipsomania. *Puerperal insanity* shows itself during the first seventeen days after labor, and is of sudden incidence; the mental symptom is acute delirious mania. Prognosis is favorable in this, as in the insanity of pregnancy. (*Vide* J. Batty Tuke, "On Puerperal Insanity," *Edin. Med. Journ.*, May, 1865, and June, 1867.)

VII. TOXIC INSANITY.—*Insanity of alcoholism* in the acute form may be marked by acute mania of a transient nature, *mania a potu*; by melancholia, frequently accompanied by delusions and hallucinations of a frightful character; in the chronic, by a type of dementia frequently simulating general paralysis. Prognosis of the acute form favorable, in the chronic the reverse.

In employing the above classification it must be clearly borne in mind that the term of the symptom should, whenever possible, be appended to the pathogenetic term; thus, puerperal mania, climacteric melancholia, senile dementia, acute idiopathic mania, epileptic mania, etc. If the terms are combined, the nature of the disease and its general psychical characteristics are expressed in terse language.

It will be noted that no separate notice has been taken of such popular terms as homicidal or suicidal insanity. They in no wise indicate a class of the insane; they are symptoms common

to many insanities, especially to epileptic, traumatic, puerperal, and idiopathic insanity, and as such must be regarded as incidents in a given case.

Terminations of Acquired Insanity.

Insanity terminates in recovery, in death, or in chronic mania or chronic dementia. Accurate statistics of the two first-named terminations are unattainable, as a large number of patients are treated at home; and asylum statistics do not therefore show the result overhead, only that of the more aggravated cases. The result of treatment in lunatic hospitals gives about 40 per cent., calculated on the admissions, which, however, include idiocy, chronic terminative insanity, and such acknowledged incurable forms of the disease as general paralysis. This figure does not of course represent the results of treatment of all the insanities, which, although there are no figures at command to support the assertion, may be fairly estimated at not less than 70 per cent., excluding idiocy. There is a general tendency of all insanities to shorten life; as already noted, some are in themselves fatal, or render their subjects less able to withstand disease. Asylum statistics show from 7 to 8 per cent. per annum as the average mortality calculated on the numbers resident.

Treatment.—The history of the treatment of insanity is divisible into three epochs—the barbaric, the humane, and the remedial. But this does not take into account the very highly humane and probably highly remedial system of treatment which obtained in very ancient times. In Egypt the temples of Saturn, and in Greece the Asclepia, were resorted to by lunatics, and the treatment there adopted was identical in principle with that of the present day. The directions given by all the classical medical authors, and especially Hippocrates and Galen, are of the soundest character. How long their influence existed it is difficult to say, but in the Middle Ages, and up to the middle of the last century, little attention was paid to the care or cure of the insane. A small proportion were received into monastic houses or immured in common jails. In 1537 a house in Bishopsgate street, London, fell into the possession of the corporation, and was appropriated for the reception of fifty lunatics. This, the first Bethlehem Hospital or Bedlam, was removed in 1675 to Moorfields, and in 1814 the present hospital in St. George's Fields was erected. St. Luke's was instituted in 1751. Bedlams, or houses of detention for lunatics, appear to have existed in other cities, but, with these exceptions, no provision was made for the insane, who were allowed to wander at large. There is good reason for believing that many were executed as criminals or witches. About 1750 the condition of the insane attracted some amount of public attention, and the incarceration in madhouses of a considerably larger number than formerly followed, not on account of any philanthropic sympathy with their condition, but as a measure demanded for the public safety and comfort. But this measure by no means brought about the termination of the barbaric period. The houses, misnamed asylums, were in the hands of private parties, under little or no supervision, and were, in fact, merely prisons of the very worst description. The unhappy inmates were immured in cells, chained to the walls, flogged, starved, and not infrequently killed. It is almost impossible to believe that this condition of matters existed far on into the present century. According to Conolly, "there is clear proof of the continued existence of these abuses in 1827; and it cannot be denied that not a few of them survived in some public and private asylums in 1850." Matters were no better in France when Pinel was appointed in 1792 to the charge of the Bicêtre, the great hospital of Paris for male lunatics. In that establishment, and in the Salpêtrière, the condition of the inmates was as degraded as in the British madhouses. This great philanthropist adopted the bold step of striking off the chains and other engines of restraint from those under his care. About the same time, the most gross abuses having been brought to light in connection

with the management of the City of York asylum, William Tuke, a member of the Society of Friends, was mainly active in instituting the York Retreat for the care and cure of insane members of that sect. This real asylum was conducted on non-restraint principles. The names of Pinel and Tuke are indissolubly connected with the history of the humane treatment of the insane, and to their efforts must be ascribed the awakening not only of the public but of the medical profession to the true principles of management. It took, however, many years before the principles laid down by these men were universally adopted. In 1815 a committee of the House of Commons brought to light many gross abuses in Bethlehem Hospital, and it was not till 1836 that mechanical restraint was entirely abolished in an English public asylum. This took place at Lincoln, where Dr. Gardiner Hill did away with all engines of restraint. Shortly afterward Conolly adopted the same line of treatment at Hanwell, near London, and through the influence of his example and precept the measure extended over the whole of Great Britain. Experience has shown that, as restraint of all forms is abandoned, the management of lunatics becomes easier. Walled-in airing-courts, barred windows, and strong, dark rooms have almost entirely disappeared, and in some Scotch asylums it is found practicable to discontinue the use of lock and key. It has been said that the type of insanity has changed within the last forty years; it would be more true to say that the type of treatment has changed. It is much less common nowadays to meet with those extremely violent forms of madness which entered into the description of many authors. With the reduction of restraint a higher order of supervision on the part of attendants is demanded, and as they are trained to rely more and more on the moral influence they can exercise over their charges, and less on mechanical apparatus, the patient is not so apt to resent control, and therefore a greater calm and contentment pervade the atmosphere of our asylum wards. This has been mistaken for a change in the type of the disease.

LAW.

The effect of insanity upon responsibility and civil capacity has been recognized at an early period in every system of law. In the Roman jurisprudence its consequences were very fully developed, and the provisions and terminology of that system have largely affected the subsequent legal treatment of the subject. Its leading principles were simple and well-marked. The insane person having no intelligent will, and being thus incapable of consent or voluntary action, could acquire no right and incur no responsibility by his own acts; his person and property were placed after inquiry by the magistrate under the control of a *curator*. The different terms by which the insane were known, such as *demens*, *furiosus*, *fatuus*, although no doubt signifying different types of insanity, did not infer any difference of legal treatment. They were popular names which were used somewhat indifferently, but which all denoted the complete deprivation of reason. During the Middle Ages the insane were but little protected or regarded by law. Their legal acts were annulled, and their property placed under control, but little or no attempt was made to supervise their personal treatment. In England the wardship of idiots and lunatics, which was annexed before the reign of Edward II. to the king's prerogative, had regard chiefly to the control of their lands and estates, and was only gradually elaborated into the systematic control of their persons and property now exercised in chancery. Those whose means were insignificant were left to the care of their relations or to charity. In criminal law the plea of insanity was un-

availing except in extreme cases. About the beginning of this century a very considerable change commenced. The public attention was very strongly attracted to the miserable condition of the insane who were incarcerated in asylums without any efficient check or inspection; and at the same time the medical knowledge of insanity entered on a new phase. The possibility and advantages of a better treatment of insanity were illustrated by eminent physicians both in France and England; its physical origin became generally accepted; its mental phenomena were more carefully observed, and its relation was established to other mental conditions which had not hitherto been regarded as insane in the proper sense of the word.

The fact of insanity may operate in law—(1) by excluding responsibility for crime; (2) by invalidating legal acts; (3) by affording ground for depriving the insane person by a legal process of the control of his person and property; or (4) by affording ground for putting him under restraint.

INSCRIPTIONS in characters sometimes termed cuneiform or wedge-shaped, sometimes arrow-headed, have been found throughout a large part of western Asia—in Persia and Babylonia, Assyria and Media, Armenia and Mesopotamia. The names given to the characters are derived from their form, as some of them resemble the points of arrows, though most have the appearance of wedges, thicker at one end than at the other. This appearance is due to the fact that the characters were originally impressed upon moist clay by a metal stylus, and the form consequently assumed by them was subsequently imitated by the engraver upon stone and metal. The characters were primarily pictorial, but in course of time the outlines of the primitive pictures came to be alone preserved, while the nature of the writing materials caused curves to become angles, and rounded lines straight ones.

The original home of the cuneiform system of writing was either Elam or Babylonia, the inventors of the hieroglyphics in which it originated being the ancient Accadian population of Chaldea. It passed from the latter to a number of other nations, undergoing at the same time a variety of modifications. It was first borrowed by the Semitic settlers in Babylonia and Assyria, and from them it was handed on to the Turanian tribes of India, the Alarodians of ancient Armenia, and the Aryans of Persia, while the Turanian inhabitants of Elam or Susania preserved the system as it had been in use among the Accadians of Chaldea.

In Babylonia, Assyria, Susania, and Media the forms of the characters underwent several changes at successive periods, the tendency in each case being to simplify the characters by dropping superfluous wedges. In Babylonia we have to distinguish between the archaic, the linear, the hieratic, and the later forms of the characters. The archaic forms are principally found on bricks and cylinders of the Accadian epoch (before 2000 B.C.), and are the oldest forms of the characters of which we have contemporary specimens. The linear forms were in use at the same time, and are marked off from the archaic forms by being written in continuous lines instead of a series of wedges, and sometimes also by a closer resemblance to the original pictures from which they were derived. The hieratic forms were mainly employed between the overthrow of the Accadian power (about 1700 B.C.) and the eighth century B.C., more especially for contracts and similar documents. The later forms may be seen on the monuments of Nebuchadnezzar and his successors, a further modification of them being used for the Babylonian transcripts of the Persian cuneiform inscriptions. In Assyria also we may classify the characters as archaic, hieratic, and

later (or Ninevite), though the forms they assumed in Assyria were not identical with those used in Babylonia which we have called by similar names. The hieratic forms were mainly employed in Assyria for ornamental or religious purposes, and may be compared with our own black letter. In Susiana the archaic forms of the characters lingered to the last, though in the northern part of the country simplified forms were in use. In Media a considerable difference may be observed between the peculiar forms of many characters in the older inscriptions of Mal-Amir and the forms borne by them in the Protomedic transcripts of the Persian monuments. The Armenian or Vannic characters were the same as those of Assyria, except that where one line or wedge had to be drawn across another, it was broken into two. But this was to prevent the stone from breaking at the point of section.

It will be noticed that the cuneiform characters were employed to express very different languages. The Accadian, like the allied dialects of Susiana and primitive Media, was agglutinative, and probably belonged to the Ural-Altaic family of speech; Assyrian and later Babylonian were Semitic; Persian was East Aryan; while the Armenian of Van seems to claim affinity with that Alarodian group of tongues of which Georgian may be regarded as the modern representative.

As already stated, the cuneiform characters were in their origin pictorial. In many cases it is possible to restore the primitive hieroglyphics or ideographs by the help of the archaic and linear Babylonian forms, and a fragment of a clay tablet has been discovered on which the pictorial originals of a few characters are given. In order to restore the primitive pictures, it is frequently necessary to turn a character upon its side, from which we may infer that the ideographs were once written vertically like Chinese.

The primitive pictures denoted either objects or ideas, the latter being represented metaphorically by the picture of one or more objects. "Life," for example, was expressed by the picture of a growing flower, "a month" by placing the numeral xxx. within the circle of the sun, which symbolized the day. But the same picture might denote more than one idea or object. Thus the circle of the sun represented not only "the sun" and "the day," but also "light," "brilliance," and the like; and a pair of legs represented the ideas of "going," "walking," and "running." By combining two or more ideographs together, fresh ideas might be symbolized to an almost infinite extent; "drinking," for example, is denoted by placing three drops which denoted water within the picture of the mouth, "language" by substituting the tongue for the three drops of water, and "a tear" by setting the ideograph of water before that of the eye.

Out of this early picture-writing there soon grew a syllabary. Accadian was an agglutinative language, which was already largely affected by phonetic decay, the result being that on the one hand the same word might be used indifferently for noun, verb, and adverb, as in English, while on the other hand the loss of final sounds had reduced a great part of the vocabulary to the condition of monosyllables. Ideographs consequently came to be associated with the sounds of the words which they primarily or most usually represented, and these words were mostly monosyllabic.

A further step in advance was now taken. An ideograph continued to represent the pronunciation of the word for which it originally stood, even when it no longer represented the word itself; that is to say, the pronunciation of the word it denoted became attached to it as a mere phonetic value. This important innovation, which amounted to a change of the old picture-writing into a syllabary, must have taken place at an

early period in its history. Like the lexicographers of China, the lexicographers of Accad attempted to classify and arrange the characters of their syllabary. Every character received a name of its own, so that literary works could be copied from dictation. A list of primary characters was first drawn up, each of which was named from the object it originally represented. The remaining characters were regarded as compounds, and divided into two classes. The first class consisted of characters which differed from the primary ones in having extra wedges, the second class of those that were really compounds. This classification of the syllabary must have been completed at a very remote date, since the analysis of many of the compound characters can only be explained by the forms they bear in archaic Babylonian, and in some cases even the archaic Babylonian forms are not sufficiently primitive. We may gather from this some idea of the epoch to which the invention of the cuneiform system of writing reaches back.

As far back as the second millennium B.C. Semitic tribes were in possession of a part of Chaldea. Duigi, the son and successor of the first Accadian monarch of whom we have contemporaneous record, has left us an inscription in which the cuneiform system of writing is adapted to the expression of a Semitic language. By the seventeenth century B.C. the Accadian language seems to have been wholly superseded by Semitic Babylonian and its northern dialect Assyrian.

The real difficulty the cuneiform syllabary offers to the decipherer is not the polyphony of the characters, but one which would not have been felt by the Assyrians themselves. Accadian and Assyrian phonology did not always agree, and in borrowing the Accadian system of writing the Assyrians had to adapt the sounds of their own language, as best they could, to the phonetic symbols of another.

The Assyrians continued to follow the example of the Babylonians in writing on clay, but they also made use of papyrus and stone. This literature on clay is very extensive, and embraces every branch of study known at the time.

The learned court of Assur-bani-pal in the seventh century B.C. amused itself with essays in Accadian composition, the extinct language of primitive Babylonia standing in much the same relation to the Assyrians that Latin does to us. But literary Assyrian itself was fast becoming an artificial dialect. The Aramæan alphabet was introduced into Nineveh at least as early as the eighth century B.C., and, though Nebuchadnezzar and his successors continued to employ the cuneiform syllabary, the conquest of Babylon by Cyrus was a blow from which the old mode of writing never recovered. The literary dialect and the characters in which it was inscribed were more and more disused, and finally disappeared altogether. Commercial tablets, however, dated in the reigns of the earlier Arsacid princes, have been found written in cuneiform, and if M. Oppert's identification is correct, a deed of sale, now in the Zurich museum, and written in cuneiform characters, is dated in the fifth year of Pacorus, the contemporary of Domitian.

The Assyrian syllabary was borrowed by the Armenians and Minnians of Lake Van in the reign of a certain king named Lutipri in the ninth century B.C. The characters both in form and use are identical with those of Nineveh, except that the Armenians rejected the polyphony of the Assyrian syllabary, and with one or two exceptions used each sign with one phonetic value only.

After the occupation of Armenia by the Aryans, the use of the cuneiform character seems to have been dis-

continued, and no "Vannic" or Armenian cuneiform inscriptions are known to exist of later date than the seventh century B.C.

It was reserved for the Aryans of Persia to discover the ultimate capabilities of the cuneiform system of writing by reducing its characters to an alphabet of forty letters. These were divided into two classes, those with an inherent vowel *a*, and those which were followed by *u* and *i*. At the same time all the superfluous wedges were thrown away, and the forms of the characters thus simplified as much as their pronunciation. Doctor Oppert has pointed out the principle upon which the formation of this new alphabet was carried out. Some one meaning was selected among those a character might bear when used as an ideograph, and this was rendered by its Persian equivalent. The initial sound of the letter was the alphabetic value henceforth represented by the character. A few ideographs were retained along with the alphabetic characters. The Persian cuneiform alphabet, called "Assyrian letters" by Herodotus, seems to have been invented in the early part of the reign of Darius, and, being confined to monumental purposes, soon fell into disuse.

Possibly the reduction of the cuneiform syllabary into an alphabet was suggested by a previous acquaintance with alphabetic writing. In the Persian inscriptions the words are divided from one another by an oblique wedge. A similar division of words is found in one or two Assyrian inscriptions.

The earliest inscription in the Phœnician alphabet known to us is the stele of Mesha, king of Moab, found at Dhibân and belonging to the ninth century B.C. In this Mesha relates that after the death of Ahab his god Chemosh enabled him to shake off the yoke of Israel, to drive the Gadites out of Ataroth, and to fortify Kir-hareseth, Aroer, Horonaim, Dibon, and other places. The language of the inscription differs only dialectically from Hebrew.

To the same form of the alphabet belong most of the Phœnician inscriptions on the engraved gems brought of late years from Assyria and Babylonia, among which may be mentioned a cone with the image of a "golden calf" and the names Shemaiah and Azariah.

The most important monument of the Sidonian period of the Phœnician alphabet is the sarcophagus of Eshmun'azar, son of Tabnith (? Tennes), "king of the Sidonians," which is probably of the sixth century B.C. It may, however, be later. The inscription upon it states that Eshmun'azer had restored the ruined temples of Sidon, and prays the gods to preserve to that city the possession of "Dor, Joppa, and the rich cornlands in the plain of Sharon." Other noteworthy monuments of the same period are the so-called "Second Sidonian Inscription," which records the installation of a subordinate "king of Sidon" by a "king of the Sidonians" of Phœnicia; the inscriptions from Citium in Cyprus of King Pummyathon and his father Melecyathon in the fourth century B.C., as well as the bilingual Phœnician-Greek and Phœnician-Cypriote inscriptions from the same island, the Phœnician-Cypriote inscription of Melecyathon having furnished Mr. George Smith with the key to the Cypriote syllabary; together with six inscriptions from Athens and two from Malta; and the three inscriptions found by M. Renan at Umm-el-Awâmid on the Phœnician coast.

The numerous dedicatory inscriptions found on the site of Carthage are written in what is termed the Punic development of the Sidonian alphabet; all apparently belong to the Greek period. The most important Punic inscription is the tariff of sacrifices found at Marseilles in 1845, an abridged edition of which was discovered on the site of Carthage by Mr. Davis in 1860.

The regulations contained in it have a striking analogy to many of those of Leviticus. Its date, however, cannot be very early, since it makes no mention of human sacrifices. The Punic alphabet was the source of those of Numidia and Boetica, where inscriptions have been found.

The series of Aramæan inscriptions begins with the dockets on Assyrian contract-tablets of the age of Tig-lath-Pileser II. and his successors, when Nineveh and Carchemish became the chief centers of trade in western Asia.

Starting from the first century B.C., the ruins of Palmyra and Taiba have furnished us with a large number of inscriptions in the Aramaic dialect of the locality. MM. de Vogué and Waddington alone have discovered more than a hundred of them. Most of them are written in what may be termed uncial characters, but there are a few in a cursive hand. Among the persons mentioned in them is Odeinath (Odenatus), the husband of Zenobia. Palmyrene inscriptions have been met with in Africa and Rome, and a bilingual one (in Palmyrene and Latin) has lately been found at South Shields, England.

The Nestorian Syrians carried their language and letters as far even as China. The celebrated inscription Sigan-fu is written in good Estrangelo of the eighth century. A Hebrew inscription has also been found at Khai-fong-fu.

Ancient Hebrew epigraphy is poorly represented. The earliest Hebrew inscriptions are three from Siloam, one of which is addressed to "Baal of the temple," a fragment found in the streets of Jerusalem by M. Vernes, and a boundary stone discovered by M. Ganneau near Gezer. The royal names on the pottery found near the foundations of Solomon's temple are not Hebrew, but Phœnician. The Maccabean period has left us several inscribed monuments and coins.

Arabic epigraphy begins with the rise of Islam. Two systems of writing were used concomitantly, the Cufic or uncial, and the Neski or running hand, neither of which, however, can be derived from the other. The earliest inscriptions yet known are two sepulchral ones, the first of which has been published by Wetzstein, Waddington, and De Vogué, while the other has lately been discovered by Sachau at Zebed. A Cufic inscription, dated 693 A.D., has been copied by De Vogué, at Jerusalem, and the old cemetery near Assuan contains a large number of similar inscriptions, some of which, as deciphered by Count Amari, contain the names of the companions of the prophet. Unfortunately this cemetery has never been thoroughly examined. Mention may also be made of Cufic inscriptions at Bozra, in Sicily, and elsewhere. Inscriptions in Greek and Neski Arabic have been found at Damascus, Tiberias, and other places, one of which is dated 696 A.D., while others are even older.

GREEK.

Etymologically the term inscription would include much more than is commonly meant by it. It would include words engraved on rings, or stamped on coins, vases, lamps, wine-jar handles, etc. Giving the term inscription a somewhat narrower sense, we still include within it a vast store of documents of the greatest value to the student of Greek civilization. It happens, moreover, that Greek inscriptions yield the historian a richer harvest than those of Rome. Partly from fashion, but partly from the greater abundance of the material, the Romans engraved their public documents (treaties, laws, etc.) to a large extent on bronze. These bronze tablets, chiefly set up in the Capitol, were melted in the various conflagrations, or were carried off to feed the mint.

the conqueror. In Greece, on the contrary, the mountains everywhere afforded an inexhaustible supply of marble, and made it the natural material for inscriptions. Some Greek inscribed tablets of bronze have come down to us, and many more must have perished in the sack of cities and burning of temples. A few inscriptions on small, thin plates of lead, rolled up, have survived; these are chiefly imprecations on enemies or questions asked of oracles. But as a rule the material employed was marble. These marble monuments are often found *in situ*; and, though more often they were used up as convenient stones for building purposes, yet they have thus survived in a more or less perfect condition.

Inscriptions were usually set up in temples, theaters, at the sides of streets and roads, in temple precincts, and near public buildings generally. At Delphi and Olympia were immense numbers of inscriptions—not only those engraved upon the gifts of victorious kings and cities, but also many of a more public character. At Delphi were inscribed the decrees of the Amphictyonic assembly, at Olympia international documents concerning the Peloponnesian cities; the Parthenon and Acropolis were crowded with treaties, laws and decrees concerning the Athenian confederation; the Heræum at Samos, the Artemisium at Ephesus, and indeed every important sanctuary, abounded with inscriptions. It is a common thing for decrees to contain a clause specifying where they are to be set up, and what department of the state is to defray the cost of inscribing and erecting them. Sometimes duplicates are ordered to be set up in various places; and, in cases of treaties, arbitrations and other international documents, copies were always set up by each city concerned. Greek inscribed marbles varied considerably in their external appearance. The usual form was a plain slab, from three to four or even five feet high, three or four inches thick, tapering slightly upward from about two feet wide at bottom to about eighteen inches at the top, where it was either left plain or often had a slight molding, or still more commonly was adorned with a more or less elaborate pediment; the slab was otherwise usually plain. Another form was the altar, sometimes square, oftener circular, and varying widely in size. It was also common to inscribe state documents upon the surface of the walls of a temple, or other public building. The workmanship and appearance of inscriptions varied considerably according to the period of artistic development. The letters incised with the chisel upon the wall or the stele were painted in with red or blue pigment, which is often traceable upon newly unearthed inscriptions.

The primary value of an inscription lay in its documentary evidence. In this way they are continually cited and put in evidence by the orators. But the Greek historians also were not slow to recognize their importance. Herodotus often cites them, and in his account of the victory of Plataea he had his eye upon the tripod-inscription. Thucydides' use of inscriptions is illustrated by numerous passages in his works. Polybus used them still more. In later Greece, when men's thoughts were thrown back upon the past, regular collections of inscriptions began to be made by such writers as Philochorus (300 B.C.), Polemo (second century B.C.), Aristodemus, Craterus of Macedon, and many others.

At the revival of learning, the study of inscriptions revived with the renewed interest in Greek literature. Cyriac of Ancona, early in the fifteenth century, copied a vast number of inscriptions during his travels in Greece and Asia Minor; his MSS. collections were deposited in the Barberini library at Rome, and have

been used by other scholars. Succeeding generations of travelers and scholars continued to collect and edit, and Englishmen in both capacities did much for this study.

Thus early in this century the store of known Greek inscriptions had so far accumulated that the time had come for a comprehensive survey of the whole subject. And it was the work of one great scholar, Augustus Boeckh, to raise Greek epigraphy into a science. At the request of the Academy of Berlin he undertook to arrange and edit all the known inscriptions in one systematic work. He lived to see the work completed, although other scholars were called in to help him to execute his great design.

Meanwhile the liberation of Greece and increasing facilities for visiting the Levant combined to encourage the growth of the subject, which has been advanced by the labors of many scholars, and chiefly Ludwig Ross, Leake, Pittakys, Rangabé, Le Bas, and later by Meier, Sauppe, Kirchhoff, Kumanudes, Waddington. Together with the development of this school of writers, there has gone on a systematic exploration of some of the most famous sites of antiquity, with the result of exhuming vast numbers of inscriptions.

The result of this has been that Boeckh's great work, though it never can be superseded, yet has ceased to be what its name implies. The four volumes of the *C. I. G.* contain about 10,000 inscriptions. But the number of Greek inscriptions now known has been estimated at 20,000 or 30,000.

ROMAN.

Roman Inscriptions (by which general name are designated, in classical archaeology, all non-literary remains of the Latin language, with the exception of coins, letters and journals) fall into two distinct classes, viz. (1) those which were written upon other objects of various kinds, to denote their peculiar purpose, and in this way have been preserved along with them; and (2) those which themselves are the objects, written, to be durable, as a rule, on metal or stone. The first class is that of *inscriptions* in the stricter sense of the word (styled by the Romans *tituli*, by the Germans *Aufschriften*); the second is that of instruments or charters, public and private (styled by the Romans first *leges*, afterward *instrumenta* or *tabulæ*, and by the Germans *Urkunden*). No ancient Latin authors have professedly collected and explained or handed down to us Roman inscriptions. Some of the orators and historians, such as Cicero, Livy, Pliny the elder, and Suetonius among the Latins, and Polybus, Dionysius of Halicarnassus, and Josephus among the Greeks, occasionally mention inscriptions of high historical interest. A few grammarians, as for example, Varro, Verrius Flaccus, and Valerius Probus of Berytus, quote ancient words or *formulae* from them, or explain the abbreviations used in them. Juridical instruments, laws, constitutions of emperors, *senatus consulta*, and the like appear here and there in the various collections of Roman jurisprudence.

Inscriptions have been found in nearly every center of ancient Roman life, but, like many other remains of antiquity, only seldom in their original sites. The great mass of them has to be sought for in the large European museums of ancient art, and in the smaller local collections of ancient remains which occur nearly everywhere in the European provinces of the former Roman empire, as well as in the north of Africa, and also here and there in Asia Minor.

Only those copies of inscriptions are to be received with full confidence which are furnished by experienced and well-equipped scholars, or which have been made

with the help of mechanical methods (casts, photographs, moist and dry rubbings) not always applicable with equal success, but depending on the position and the state of preservation of the monuments.

INSECTIVOROUS PLANTS. Insectivorous or, as they are sometimes more correctly termed, carnivorous plants are, like the parasites, the climbers, or the succulents, a physiological assemblage belonging to a number of distinct natural orders. They agree in the extraordinary habit of adding to the supplies of nitrogenous material afforded them in common with other plants by the soil and atmosphere, by the capture and consumption of insects and other small animals. The curious and varied mechanical arrangements by which these supplies of animal food are obtained, the ways and degrees in which they are utilized, and the remarkable chemical, histological, and electrical phenomena which accompany these processes of prehension and utilization, can only be understood by a separate and somewhat detailed examination of the leading orders and genera.

The best known and most important order—the *Droseraceæ*—is placed among the calycifloral exogens, and has obvious affinities with the *Saxifragaceæ*. It includes six genera—*Byblis*, *Roridula*, *Drosera*, *Drosophyllum*, *Aldrovanda*, and *Dionæa*, of which the last three are monotypic, *i.e.*, includes only one species. The curious pitcher-plant, *Cephalotus follicularis*, is usually raised to the dignity of a separate natural order *Cephalotaceæ*, though Bentham and Hooker (*Gen. Plant.*) place it among the *Ribesiaceæ*. The *Sarraceniaceæ* are thalamiflorals, and contain the genera *Sarracenia*, *Darlingtonia*, *Heliamphora*, while the true pitcher-plants or *Nepenthaceæ*, consisting of the single large genus *Nepenthes*, are placed near the *Aristolochiaceæ* among the *Apetalæ*. Finally the genera *Pinguicula*, *Utricularia*, *Gentlisea*, and *Polypompholix* belong to the gamopetalous order *Utriculariæ*. Thus all the four leading divisions of the exogenous plants are represented by apparently unrelated orders; certain affinities, however, are alleged between *Droseraceæ*, *Sarraceniaceæ*, and *Nepenthaceæ*.

While the large genus *Drosera* has an all but world-wide distribution, its congeners are restricted to well-defined and usually comparatively small areas. Thus *Drosophyllum* occurs only in Portugal and Morocco, *Byblis* in tropical Australia, and, although *Aldrovanda* is found in Queensland, in Bengal and in Europe, a wide distribution explained by its aquatic habit, *Dionæa* is restricted to a few localities in North and South Carolina, mainly around Wilmington. *Cephalotus* occurs only near Albany in Western Australia, *Heliamphora* on the Roraima Mountains in Venezuela, *Darlingtonia* on the Sierra Nevada of California, and these three genera too are as yet monotypic; of *Sarracenia*, however, there are six or eight known species scattered over the eastern States of North America. The thirty-six species of *Nepenthes* are mostly natives of the hotter parts of the Indian Archipelago, but a few range into Ceylon, Bengal, Cochin China, and some even occur in tropical Australia on the one hand, and in the Seychelles and Madagascar on the other. *Pinguicula* is abundant in the north temperate zone, and ranges down the Andes as far as Patagonia; the 150 species of *Utricularia* are mostly aquatic, and some are found in all save polar regions; their unimportant congeners, *Gentlisea* and *Polypompholix*, occur in tropical America and southwestern Australia respectively. It is remarkable that all the insectivorous plants agree in inhabiting damp heaths, bogs, marshes, and similar situations where water is abundant—a peculiarity perhaps due to their habit of copious secretion and consequent need of water.

The common Sundew (*D. rotundifolia*) has extremely

small roots, and bears five or six radical leaves horizontally extended in a rosette around the flowerstalk. The upper surface of each leaf is covered with gland-bearing filaments or “tentacles,” of which there are on an average about two hundred. Each gland is surrounded by a large dew-like drop of a viscid but transparent and glittering secretion, and the popular names (Sundew, French *Rossolis*, German *Sonnentau*) as well as the Linnæan have been thus suggested.

Insects seem to be attracted by the leaves of *Drosera*, but whether by their color, their glittering secretion, their odor, or by all three, remains as yet unsettled. A fly alighting on the disk, or even only touching one or two of the exterior tentacles, is immediately entangled by the viscid secretion; the tentacles to which it is adhering begin to bend, and thus pass on their prey to the tentacles next succeeding them inward, and the insect is thus carried by a curious rolling movement to the center of the leaf. The tentacles on all sides become similarly inflected; the blade or the leaf may even become almost cup-shaped; and the insect, bathed in the abundant secretion, which soon closes up its tracheæ, is drowned in about a quarter of an hour. The leaves clasp also, but for a much shorter time, over inorganic bodies.

The bending of the tentacle takes place near its base, and may be excited (1) by repeated touches, although not by gusts of wind or drops of rain, thus saving the plant from much useless movement; (2) by contact with any solid, even though insoluble and of far greater minuteness than could be appreciated by our sense of touch—a morsel of human hair weighing only $\frac{1}{78400}$ of a grain, and this largely supported, too, by the viscid secretion, sufficing to induce movement; (3) by the absorption of a trace of certain fluids, mostly nitrogenous. During the inflection of the tentacle, and even before it touches the stimulating object, the secretion of the gland increases in quantity, and, instead of remaining neutral, becomes acid.

The stalk of a tentacle whose gland has been stimulated by repeated shocks, continuous pressure, or the absorption of any nitrogenous fluid, particularly a solution of ammoniac carbonate, shows a mottled appearance, and, when examined under the microscope, the formerly homogeneous fluid contents of constituent cells are seen to have separated into purple masses of constantly varying number, shape and size, suspended in a colorless fluid, and the layer of colorless circulating protoplasm which lines the cells thus becomes much more distinctly visible. This process, which is termed by Darwin “aggregation of the protoplasm,” commences in the glands and gradually travels down the tentacles, being temporarily arrested at each cell-wall. The process of redissolution of the protoplasm commences at the base of the tentacles and proceeds upward. Aggregation is a vital process: the cells must be alive, uninjured, and oxygenated; if they are crushed or treated with carbonic acid, the phenomenon does not take place. It is not necessarily related to inflection, for one may be induced without the other; it is totally unlike the “plasmolysis,” or shrinking away of the protoplasm from the cell-wall, which takes place on treating a portion of vegetable tissue with any dense fluid, and which is simply due to exosmose; and it does not depend upon increased secretion. Darwin has also observed aggregation in the sensitive hairs of *Dionæa*, and in the roots of various plants; it seems indeed to be of wide distribution and profound importance in the physiology of the vegetable cell.

Dionæa Muscipula, L.—This plant, the well-known Venus’ Fly-trap, was first described in 1768 by Ellis in a remarkable letter to Linnæus, in which he gave a sub-

stantially correct account of the structure and functions of its leaves, and even suggested the probability of their carnivorism. Linnæus declared it the most wonderful of plants, yet only admitted that it showed an extreme case of sensitiveness, supposing that the insects were only accidentally captured and subsequently allowed to escape. Two American botanists, Curtis and Canby, successively advanced our knowledge of the mode of capture and digestion, which has only been investigated by Mrs. Treat, T. A. G. Balfour and others, and most fully by Darwin.

The leaves are all radical, with broad foliaceous footstalks. Each leaf has two lobes, standing at rather less than a right angle to each other, their edges being produced into spike-like processes. The upper surface of each lobe is covered with minute circular sessile glands, each consisting of from twenty to thirty cells filled with purplish fluid. It bears also three fine-pointed sensitive filaments arranged in a triangle. These contain no fibro-vascular bundles, but present an articulation near their bases, which enables them to bend parallel to the

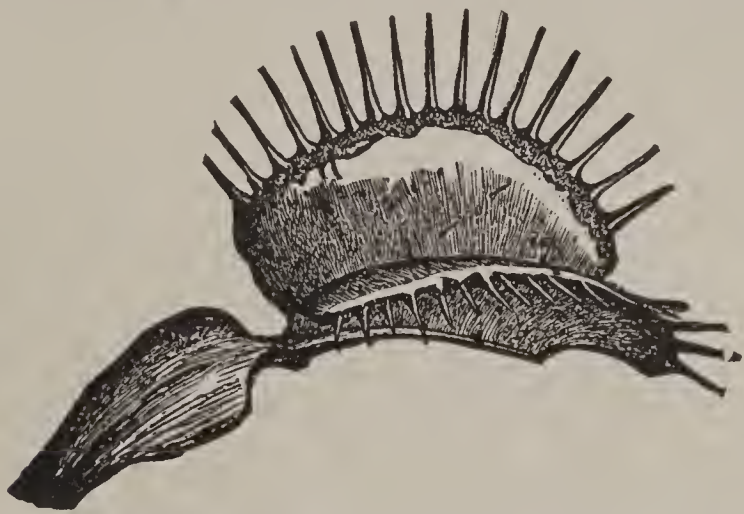


FIG. 1.—Leaf of Venus' Fly-trap (*Dionaea muscipula*), viewed laterally in its expanded state. (After Darwin.)

surface of the leaf when the lobes close. When the filaments are touched by an insect, the lobes close very sharply upon the hinge-like mid-rib, the spikes interlock, and the insect is imprisoned. If very minute and so not worth digesting, it is able to escape between the interlocked spines; more usually, however, it is retained between the lobes, which gradually but firmly compress it, until its form is distinguishable from with-

out. The leaf thus forms itself into a temporary stomach, and the glands hitherto dry commence, as soon as excited by the absorption of a trace of nitrogenous matter, to

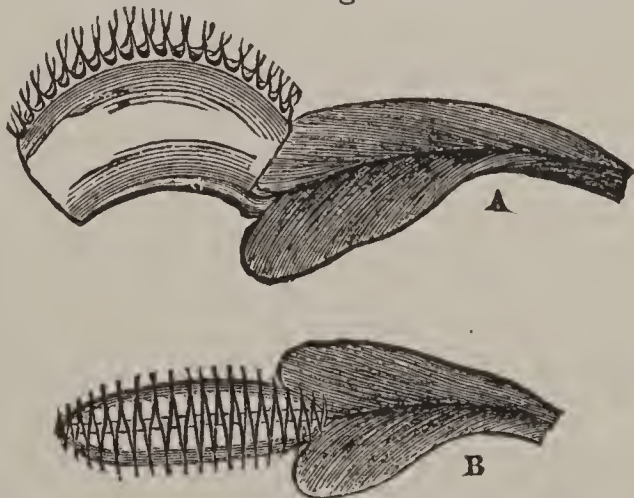


FIG. 2.—Leaf of *D. muscipula* closed over insect. A, viewed from the side; B, from above.

pour out an acid secretion containing a ferment, which rapidly dissolves the soft parts of the insect. This is produced in such abundance that, when Darwin made a small opening at the base of one lobe of a leaf which had closed over a large crushed fly, the secretion continued to run down the footstalk during the whole time—nine days—during which the plant was kept under observation. Aggregation may be observed in the

glands, and, at least on treatment with carbonate of ammonia, the aggregative process may be watched ascending the sensitive hairs.

Drosophyllum lusitanicum.—This plant catches such vast numbers of flies in a state of nature that the Portuguese cottagers call it the fly-catcher, and hang up branches of it in their houses for this purpose. Its linear leaves are thickly covered with stalked glands which resemble in the main the tentacles of *Drosera*, save in that they are incapable of movement, and that their secretion is acid before excitement. The secretion too is less viscid, and freely leaves the gland to wet the insect, which, creeping onward, soon clogs its wings and dies. There are, moreover, many minute, colorless sessile glands which only begin to secrete when stimulated by the absorption of nitrogenous matter, with which they seem to be mainly concerned.

Sarracenia.—Long supposed to be reservoirs of water for the birds, as was suggested by Linnæus, or refuges for insects from their pursuers, as was supposed by Catesby, the true function of the leaves of this curious plant has only been elucidated of recent years, mainly by the labors of Mellichamp and Hooker. The mouths of the long radical trumpet-shaped leaves are protected by a large spreading lid, the inner surface of which is abundantly smeared with nectar, and often gayly colored. Into one form of pitcher rain enters easily, into the other with difficulty. This with the mouth of the pitcher is furnished with numerous honey-secreting glands, and furnishes the attractive surface. A pathway, too, leads upward from the ground along the broad wing of the pitcher, and is at least in some species also honey-baited; along this creeping insects are lured to their destruction. Below it is the conducting surface of glassy epidermic cells, with short, downward-directed points, which like those of *Genlisea* facilitate the descent, but impede the ascent of an insect. Then comes the glandular surface, which is formed of smooth, polished epidermis with numerous glands, that secrete the fluid contents of the pitcher, and finally the detentive surface, of which the cells are produced into long and strong bristles which point downward and meet in the center of the diminishing cavity so as to render escape impossible. The secretion wets an insect very rapidly, and appears to have remarkable anæsthetic effects. It seems to be completely destitute of digestive power, indeed rather to accelerate decomposition. The pitchers accumulate vast quantities of insects in the course of a season, and must thus abundantly manure the surrounding soil when they die. Moreover, the feast is largely shared by unbidden guests (commensals). Not to speak of insects which feed upon the pitcher itself, some drop their eggs into the putrescent mass, where their larvæ find abundant nourishment, while birds often slit open the pitchers with their beaks and devour the maggots in their turn.

When Mr. Darwin's work appeared, numerous objections were made to accepting his conclusions, on the *a priori* ground that digestion was too purely an animal function to be conceivable of plants. Morren demolished these by showing that digestion—the conversion of insoluble and indiffusible proteids, fats, and amyloids into soluble and diffusible compounds by means of appropriate ferments—is not confined either to animals or to carnivorous plants, but is a universal property of living beings, in fact the necessary preliminary of all assimilation. Not only are all the important animal digestive ferments represented among plants, but vegetable physiologists have made us acquainted with several ferments—synaptase, erythrozyme, myrosine, etc.—which have no known analogues in the animal kingdom. It is merely the exudation, not the existence, of the

ferment, then, which is remarkable in carnivorous plants, and this Darwin suggests might begin by an exosmose accompanying the absorption of animal matter by any plant possessing viscid glandular hairs, and, once set up, would be perfected by natural selection. Insectivorous plants, too, are not the only ones which exhibit peculiarities of nutrition. The true parasites absorb the juices of the plants which they infest, and, not to mention the fungi, many of which subsist partly or wholly on animal matter, the phanerogamous saprophytes live by absorbing the partially decomposed materials of other plants; and from the absorption of vegetable to that of animal matter the transition is easy. The reciprocal case, too, occurs in the animal kingdom; animals possessing chlorophyll have been shown to nourish themselves like plants, without feeding, by decomposition of carbonic acid and the formation of starch in sunlight, and thus carnivorous plants—trespassers into the animal kingdom—are paralleled by vegetating animals. Thus, then, we have only to change our standpoint, and look, not at the anomalous plant or animal, but at the essentially similar cells, and the yet more essentially similar protoplasm of which both are composed, to see that their apparent anomalies are but additional proofs of the unity of nature.

INSECTS. The Insecta, or Insects, from the largest class of that division of the animal kingdom formerly called *Articulata*, but for which the more expressive term *Arthropoda* (joint-footed) is now more generally employed. This term includes, besides *Insecta*, the classes *Crustacea*, *Arachnida* and *Myriopoda*.

The chief diagnostic characters of an Insect, as combinedly distinguishing it from a Crustacean, an Arachnid, or a Myriopod, are as follows:—Legs usually (never more than) six in number; two antennæ; ordinarily two pairs of more or less membranous wings; head, thorax, and abdomen distinctly separated; respiration effected by means of internal tracheæ, which communicate with the air by lateral openings termed spiracles or stigmata, or by external plates or filaments (these ordinarily only in the preparatory conditions of aquatic forms), which absorb air and convey it to the tracheæ. A reference to the articles on the other classes of *Arthropoda* will indicate in what way these diagnostic points are modified in them.

As in all organized beings, the limits of the class are not strongly defined, for, although it is not difficult to indicate an insect, speaking broadly, there are certain small groups that do not satisfactorily fall into the class as limited by strongly marked lines of demarcation.

At the head of this article it is stated that the *Insecta* form the largest group of the *Arthropoda*; it might probably be said with justice that they far outnumber all the other members of the animal kingdom combined. It is certain that at the present time 80,000 presumably distinct species of beetles have been described, and it is safe to assume that the number of known species of other orders is greater, thus giving a total of about 200,000. And yet we are only on the threshold of a knowledge of the forms that actually exist in nature, many enormous groups of minute forms being still only very partially studied. In fact, it may be confidently anticipated that some day the number of known forms will not fall far short of 1,000,000.

Fossil indications of insects have been discovered in

the Devonian series, and in the Carboniferous they become rather more numerous; but, with few exceptions, these all belong to those orders in which the metamor-



FIG. 3.—Leaves of *Sarracenia purpurea*. A, attractive surface of lid; B, conducting, C, glandular, and D, detentive surface; magnified. A and D are taken from *S. flava*.

phoses are incomplete, and there is no evidence that any anthophilous insects (such as *Lepidoptera* or *Hymenoptera*) were then in existence. Ascending the geological scale to the Mesozoic age, the representatives of the older groups become very numerous, and often of gigantic size. *Coleoptera* are fairly well indicated; and the flower-loving *Lepidoptera* and *Hymenoptera* make their appearance, but in very small numbers. In the Tertiary rocks remains become sometimes very abundant, and of all orders; and in the post-Tertiary or Quaternary period these remains consist largely of those of species now existing. One of the most interesting features in fossil entomology is the well-known occurrence of myriads of insects entombed in the fossil resin known as amber, preserved in the most beautiful manner, and belonging for the most part to genera now existing, but differing specifically. In alluding to this it is well to mention that the insects found in gum copal and other recent resins are, on the contrary, of existing species. As in other animals, and also plants, the fossil remains prove that the distribution of heat and cold on the earth was once very different from what it is now: a fossil beetle of rather large size was discovered by our last Arctic Expedition almost at the highest northern point attained.

It may be asserted that no part of the earth's surface is without insects. They have been discovered in the Arctic and Antarctic regions at the highest point reached, and even showy butterflies of several species enliven the dreary solitudes of almost everlasting ice, as was abundantly proved by the naturalists of the *Alert* and *Discov-*

ery, who found them almost up to 83° N. latitude. But, as a rule, the larger and more brilliant forms occur within the tropics. Yet it must not be assumed, as is sometimes erroneously done, that the majority of tropical insects are large and brilliant, and the smaller and more obscure forms comparatively less numerous. Recent investigations by competent observers show that the latter are at least as abundant in the tropics as in temperate regions, and that it is the wealth of large forms that has caused the others to be overlooked.

The attempts at subdivision of the globe into zoölogical regions, so successful with regard to mammals, and in a smaller degree with birds, have not been so entirely satisfactory with regard to insects, more especially as concerns the separation of the Palæarctic and Nearctic regions; still there is often a very marked localization in particular groups, which divide themselves specifically to an infinite extent within very circumscribed areas, and are found nowhere else. The results obtained from minute investigation of insular faunæ have derived much of their value from insects, and have occasioned much valuable philosophical speculation on the origin both of the islands themselves and of their faunæ and floræ. Space will not permit of detailed allusion to the apparent affinity shown by the insect inhabitants of regions now very widely separated, such, for instance, as that of Western Europe, with Western (rather than Eastern) North America, of Australia and New Zealand with Chili, of Chili and the southern extremity of South America with the Palæarctic region, etc.

As special points of distribution may be mentioned the occurrence of insects in hot springs, in brine, in the deepest caves (these are usually blind), below low-water mark, and even on the surface of the ocean (the genus *Halobates* in the *Hemiptera*) very far from land.

The power of many insects to acclimatize themselves rapidly when accidentally introduced into new regions is very marked, and adds to the difficulty often experienced in considering what species are really endemic and what introduced, especially in islands. The maximum duration of the life of a perfect insect is probably attained in bees and ants, the females or queens of which are known to live at least seven years; the minimum is found in some species of May-flies (*Ephemeroidea*), in which twenty-four hours is perhaps the limit. But the length of life of a perfect insect is sometimes in direct opposition to that of the same insect in its preparatory stages, and some of the *Ephemeroidea* that live at most but a few days in their aerial form have taken three years to complete their growth in their sub-aquatic stages. Temperature also has a marked effect on some species. The common house-fly, for instance, will complete its whole life cycle from embryo to fly in a few days in the heat of summer, but requires very much longer in cold weather.

Among insects that are of direct benefit to man, the hive-bee and the silkworm moth stand preëminent, and the cochineal and lac insects are scarcely of less importance. No substitutes for silk, honey, and beeswax have been or are likely to be discovered; but, on the other hand, chemical discoveries have now occasioned the disuse of some insect products that were formerly valuable articles of commerce, and in this category nothing is more remarkable than the manner in which the oak-gall of commerce has given way to inorganic substances in the manufacture of ink. As food for man, insects play a very unimportant part, and they can scarcely be said now to form part of the diet of the more highly civilized races, notwithstanding an attempt lately made in America so to utilize the masses of the destructive Rocky Mountain locust. Yet locusts themselves (with other large insects) are eaten raw or

cooked by the inhabitants of more than one part of the globe, and, the large fleshy grubs or larvæ of beetles and other insects are as much esteemed as delicacies by the natives of some countries as the *Cossus* (the precise identity of which appears involved in some uncertainty) was by the luxurious Romans. The aborigines of Australia make a cake of the pounded bodies of a night-flying moth (*Noctua spini*), termed the Bugong moth; the natives of the Lake region of Central Africa make a kind of bread of the multitudes of small dead insects (chiefly *Ephemeroidea* and *Diptera*) that collect on the shores; in Central America the eggs of a large water-bug supply materials for a kind of bread.

Noxious insects are legion, and cannot be here alluded to even in the most general manner. The number of those that cause injury to man by direct attacks is comparatively small; it is by their attacks on the produce of our fields and gardens that insects assert their importance. But it should not be overlooked that the especial province of insects is to act as scavengers, and very frequently they are not the initiating cause of damage, which is rather to be sought in a previously unhealthy condition of the trees or plants; they simply step in to complete the work of destruction commenced by disease or by a low state of the vital functions.

That the action of insects in fertilizing plants was often necessary had long been known. But it is owing to the patient and laborious researches of modern naturalists (among whom the names of Darwin, Hermann Müller, and Lubbock stand prominently forward) that the vast importance of the subject has come to be understood. They have proved incontestably that in a multitude of plants the condition of the reproductive organs is such that self-fertilization is impossible; but what is of greater importance is the proof afforded that, although many plants are perfectly capable of self-fertilization, the weight and number of the seeds or fruit are often vastly increased when cross-fertilization is affected, and that this is mainly done by the action of insects, the wind and other causes playing only a minor rôle. It may be truly said that such is the correlation between plants and insects that the majority of the former would more or less gradually disappear from the earth's surface were the latter to be destroyed. In New Zealand the red clover has been introduced and flourishes, but all hopes of spreading it there have to be abandoned; the plant never perfects its seeds, owing to the absence of humble-bees, which appear absolutely necessary for its fertilization.

Among the varied relations of insects to other classes of the animal kingdom and their mutual relations, no subject is more interesting than is that of parasitism. It occurs in almost all the orders, but in very different degrees. Whole groups are naturally epizöic, others entozoic, while a few (such as fleas and bedbugs) can scarcely be arranged in either of these divisions, inasmuch as, although in one sense epizöic, it appears probable that they may occasionally be able to go through the whole of their life cycle without contact with the animals to which they otherwise appear especially attached. As true epizöa the whole group of true lice, *Anoplura* (which are probably degraded *Hemiptera*), and bird lice (*Mallophaga*, a group of uncertain affinities) are especially familiar. These cannot exist without their hosts, and their whole life is passed on them, each mammal or bird having its especial parasite (or more than one), which affects it only, or is at any rate confined to it and allied species. Such also are certain degraded forms of *Diptera*, including the bat parasites (*Nycteribia*), the bird flies (*Ornithomyia*), and others. Such also is a curious creature (*Platypus*) parasitic upon the beaver, the affinities of which are so little

marked that it has been formed into a distinct order (*Achreioptera*) by Westwood, placed in the *Hemiptera* by Ritsema, and declared to be a true beetle by Leconte. Such also is a curious little moth (*Epipyrops*, Westwood), an external parasite upon certain homopterous insects; another moth (*Tinea vastella*), lives in its larval state on the horns of living animals; and many others might be cited.

As entozoic insects, the large dipterous family *Æstridæ* is especially characteristic, all its members living at the expense of *Mammalia* in very varied manners, the stomach, throat, frontal air passages, the subcutaneous system, and even the genital organs being attacked by various winged species, but only as larvæ, the perfect insects being winged and strong flyers. Furthermore, a genus of *Diptera* (*Batrachomyia*) belonging to quite another family (*Mucidæ*) is said to attack frogs. It is scarcely just, however, to class as true parasites certain insects whose larvæ have been discharged (still living) from the nostrils, intestines, or urethra of man. Many such cases have been perfectly authenticated, but the insects have been such as certainly do not of necessity require such conditions, and these latter are not natural habitats. Accident introduced them, and they were fitted to exist, at any rate for short periods, in the interior of the human body. But the largest class of insect parasitism is that which exists between insects themselves, as exhibited in an enormous number of families (*Ichneumonidæ*, *Evaniidæ*, *Proctotrypidæ*, *Chalcididæ*, etc.) of *Hymenoptera*, etc. These are essentially parasitic in their preparatory stages, and the parasitism is of the class that may be termed entozoic. The eggs are laid either in or on the bodies of the larvæ (chiefly) of other insects, and even in the eggs, the young larvæ of the parasites feeding mostly on the adipose tissue of their hosts, often enabling the latter to undergo most of their transformations (but very rarely that to the perfect insect). To such a class belong also many dipterous insects chiefly belonging to the *Tachinidæ*. Hyper-parasitism exists in many minute species of *Chalcididæ*, which do not directly affect the hosts themselves, but which feed in the bodies of other parasites.

Luminosity is another subject which should have more than passing notice bestowed upon it. Modern scientific travelers have not succeeded in confirming Madame Merian's well-known statements with regard to the luminosity of the so-called lantern-flies (*Fulgora*), hence these have to be eliminated from the category of luminous insects. It is among the *Coleoptera* that the phenomenon especially occurs, and in them is almost confined to certain skip-jack beetles (the genus *Pyrophorus*), and probably the entire family of glow-worms (*Lampyridæ*). The luminosity is confined to certain distinct patches, differing in position and number according to the species and also according to sex—usually most observable in the female, although this does not appear to be always the case. The property is distinctly under the control of the insect, and is often exercised in an intermittent manner at stated intervals, when the insects are not under the influence of extraordinary excitement. It is probable that luminosity exists in some *Diptera*, and also in the larvæ of certain exotic *Lepidoptera*, a recent traveler having assured us that in South America a larva of this order has luminous patches along either side, so that when in motion it has been compared to a lighted-up railway train. Some occasional instances of luminosity appear to be accidental, probably owing to the insects having been feeding upon, or otherwise in contact with, decaying phosphorescent matter. With regard to the nature of the luminous substance no very precise results have been arrived at by investigators. That it is phosphorous in some form or other appears

certain, and the latest experimenter (Jousset de Bellesme) asserts as his belief that it is no other than phosphoretted hydrogen gas stored up in the cellular tissue, and in direct communication with the nervous and respiratory systems.

Galls are occasioned by the presence of the larvæ of certain species in nearly all orders of true insects, though it is among the *Cynipidæ* in *Hymenoptera* and the *Cecidomyiidæ* in *Diptera* that they are most characteristic. And they may be in almost any position on a plant, according to the species of gall-maker. The most striking, however, are clearly modified leaf or flower buds. The mystery surrounding galls is their cause. The indirect cause is the puncture of the insect, and the presence of its eggs or larvæ, but no explanation has been offered of the reason why this presence sets up the growth termed a gall. Two insects of differing species will deposit their eggs in the same position; in the one case no abnormal growth follows; in the other some peculiar irritation sets up a tumor, often enormous in size. Two insects, also of different species, but both gall-makers, do the same; in both cases a tumor ensues, but its form is totally different in the two. A most noticeable recent discovery is that by Doctor Adler (since confirmed by others) to the effect that in certain European *Cynipidæ* dimorphism to a remarkable extent occurs, and that certain genera are only conditions of others, the two forms of insects, and the totally different galls occasioned by them, being alternate in appearance.

Taking any large insect, we recognize in it three more or less distinctly separated divisions, the head, thorax, and abdomen. Taking the majority of insects, and especially of their larvæ, we recognize thirteen segments or somites, counting the head as one, the thorax as consisting of three, and the abdomen as nine. From a classificatory point of view, it is probably convenient to retain this idea, though in the abdomen of a dragonfly (for instance) there are ten quite distinct segments. But, seen in the light of embryology and morphology, a different aspect is put on. The abdomen in the embryo of some insects clearly consists of eleven segments. Moreover, if each appendage of the head be considered as a modified limb, we get in some insects as many as seven segments in this portion of the body alone. Thus, although thirteen segments is a usual and convenient number as regards the structure of an insect, this number must be vastly increased if we consider the animal in regard to other divisions of the Arthropod series. In the abdomen the actual number is sometimes very much reduced, owing to several of the segments becoming obsolescent, coalescent, or retracted.

Respiration by tracheæ is one of the main characteristics of an insect. Tracheæ are tubes ramifying in the interior of the body, the walls of which are composed of two membranes with a spiral thread between, and extending into the wings and other appendages; but in the perfect insect the main tracheæ are subject to modification, and are more or less expanded into vesicles to suit the requirements of creatures with great powers of flight, or of strong movement in other ways. The manner in which air is communicated to these tracheæ, in order that the necessary oxygen may be obtained from it, is twofold in its nature. In insects that live in free air the latter is received through lateral openings termed spiracles or stigmata, which vary in number in different insects, but there is usually one on each side of most of the segments. A spiracle usually consists of a longitudinal slit in a membrane, protected by delicate mechanism, and also by special muscles, which can close it hermetically if necessary. Many aquatic insects also breathe through spiracles, and in these cases a quantity

of air is collected (or entangled) in delicate pubescence on the surface of the body, the insect coming to the surface to obtain a fresh supply at intervals. But in the majority of aquatic insects, and especially of their larvæ or pupæ, air is obtained by means of external threads or plates, expansions of the integument, the function of which is to absorb air from water and convey it to the tracheæ by means of delicate ramifications of the tracheal system in their substance.

The food of insects is either solid or liquid, and the parts of the mouth are modified, according to requirements, into two main conditions, termed mandibulate and haustellate; but the latter term is somewhat vague, inasmuch as the modifications are by no means homologous in all haustellate insects, although the structure is subservient to the same function. Again, in both divisions the food may be either vegetable or animal in its nature, and according as this may be the parts of the digestive system are modified.

In all insects the sexes are separate. True hermaphrodites do not exist, though individual monstrosities, in which the form, coloration, and even internal organization of both sexes are combined, are not rare. The external organs are placed at or near the extremity of the abdomen, and are usually accompanied by secondary or accessory appendages often of most complex structure, serving to insure complete contact during the sexual act, and probably also to some extent excitatory. In the dragon-flies, however, the intromittent organ of the male is in the under side of the second abdominal segment, which explains the extraordinary position of the sexes when coupled.

There are certain anomalous conditions of the generative system that may be conveniently noticed here, under different headings.

In bees, wasps, and ants, and also in *Termes* (or white ants), the majority of the members of a colony is made up of individuals which as a rule have no reproductive powers. In the first three, these are aborted females, and it has been proved (at any rate for ants) that occasionally these workers lay eggs, which, however, always produce males, the production of a queen depending apparently upon special feeding in the larval stage. In *Termes* the conditions are different. There are both workers and soldiers, both incapable of reproduction, but not exclusively consisting of aborted females, since both sexes are represented. Also in *Termes* there are what have been termed complementary males and females, distinct from the pair that were once supposed to be the exclusive founders of a new colony; of these the females lay comparatively few eggs, their ovaries not acquiring the extraordinary development of those of the true queen.

Oviparous generation is the rule in insects; but there are certain departures from the rule. In the *Aphides* it is well known that both the oviparous and viviparous exist in the same species.

Metamorphoses.—All true insects may be said to undergo a metamorphosis. Such a condition is absent in the small groups known as *Thysanura* and *Collembola*. Metamorphosis may be broadly grouped into two main divisions—(1) that in which the larva changes into a pupa which, as a rule, is inactive, and which never eats, and (2) that in which there is no true pupa state, the animal continuing active, and eating, from the egg to the perfect insect. In the former the larva changes its skin, or molts, several (often many) times before it changes to the pupa, the last molt (or ecdysis) happening when it is in what may be called the pseudo-pupal condition (which may last from a few hours to several months) immediately before the pupa state is assumed; this division is usually characterized as “metabolic.”

In the latter ecdysis goes on continuously at intervals from the egg to the winged insect, and the form of the larval condition much resembles that of the perfect, the wings budding out gradually as the creature approaches maturity; the term “hemimetabolic” is applied to this division. In the first division the conditions are rather more varied than in the second. In the pupa of some *Diptera* the larval skin hardens, and within this the true pupa is formed (such a pupa is termed “coarctate”); in other *Diptera* the pupa is not contained within the larval skin (which much resembles a true cocoon), but is free and even sometimes active, the various appendages not being connected with the body, as is usually the case in that of a lepidopterous insect. The pupæ of *Hymenoptera* and *Coleoptera* are also much in the same condition, but they are not strictly active. Many writers have attempted to draw a broad distinction between such a pupa as that of a moth and that of an ant-lion or caddis-fly, cited here as extremes, because in the latter the members are free, and pupa is really active shortly before the change into the perfect state, and thus the metamorphosis is supposed to be in some respects intermediate between that of true *Metabola* and true *Hemimetabola*. But such distinctions are more apparent than real. In many of the small moths the limbs and other appendages are scarcely consolidated with the body, but simply concealed in sheaths of which the ends at any rate are free. Also in the second (or hemimetabolic) division distinction has been drawn between the larva of a May-fly and that of a bug (as instances), because the changes from an absolutely apterous condition to one in which the wings are rudimentary and from this to the perfect state are more marked in the latter. This is probably due to the number of molts being less; the form with rudimentary wings is in no way a true pupa.

INSPIRATION is a word of Latin origin, and is used to express the fact that holy men of old spake as they were moved by the Spirit of God. The idea is not exclusively Christian or Jewish; pagans have had their inspired speakers and writers and their ideas of inspiration, and these earlier pagan notions have had their effect on some of the forms which the Christian doctrine has assumed. The classical languages contain many words and phrases expressive of this idea. Artistic powers and poetic talents, gifts of prediction, the warmth of love and the battle frenzy were all ascribed to the power of the god possessing the man inspired. These words were taken over into Christian theological writing, and used to describe what Jewish and Christian divines have called inspiration. This transference of terms, which was unavoidable, produced, however, a certain confusion of thought; for pagans and Christians meant by inspiration two different things. When a pagan described inspiration, he did so by stating the marks of the state into which the inspired person fell when the fit seized him; a Christian theologian on the other hand was chiefly concerned with the result of inspiration. What the inspired person said or did or commanded was of less moment to the pagan philosopher than the fact that he was possessed, that he was passive in the hands of the inspiring deity, that he was no longer himself but the god who for the moment dwelt in him and used him as he might an inanimate instrument. But in Christian theology inspiration always has to do with the belief that God has “wholly committed to writing” His revelation, and the psychological character of the state of inspiration is of small account compared with the fact that inspiration, whatever it may be, has for its result that God’s revelation has so been committed to writing that men have it permanently, fully, and in an infallibly trustworthy way. The doc-

line of inspiration in Christian theology contains very little reference to the psychological state of the persons inspired, and when it does enter into such details we may generally trace their presence back to the influence of pagan ideas or words; it has to do with the characteristics of the writings which have been inspired. In short, the problem of inspiration in Christian theology very much comes to this:—In the Bible we have God's revelation wholly committed to writing; what are we to infer from this about the Bible? And the varying answers given to this question form the history of the doctrine. Theology distinguishes between revelation, inspiration and the canon of Scripture. Revelation is the objective approach of God to man, God entering into human life and history for man's salvation; Scripture is the record of this revelation, and inspiration provides that the record is complete and trustworthy; while the canon of Scripture gives the list of inspired writings.

Our knowledge of the opinions of ancient Jewish thinkers about inspiration comes chiefly from the Apocrypha, from Josephus, and from Philo Judæus. The writers of the Apocrypha do not give us any theory or doctrine of inspiration, but it may be easily gathered from what they say that they regarded the Scriptures of the Old Testament as the word of God, and therefore worthy of all reverence. It is in I Macc. xii. 9, that the expression, "the sacred books," is first used of Old Testament books; and it is evident that the Pentateuch or the books of the law were held in special reverence, but beyond this we do not find a doctrine of inspiration. Nor does Josephus formally state or discuss the dogma in his writings, but his language shows that he and his contemporaries believed that the Old Testament Scriptures were the work of God. The Old Testament he calls prophecy, and he declares that down to the time of Artaxerxes there was a regular succession of prophets which since then has ceased. It is Philo who first seeks to give a theory of inspiration, and he does so by bringing the reflections of Plato upon the pagan inspiration to explain the Jewish doctrine. Following Plato, Philo says that inspiration is a kind of "ecstasy," and he seems to imply that the degree of inspiration is greater in proportion to the unconsciousness or at least to the passivity of the man inspired. The prophet, he says, does not speak any words of his own; he is only the instrument of God, who inspires and who speaks through him, but he says that there are degrees of inspiration, and that all portions of Scripture are not equally inspired, or at least have not the same depth of inspiration.

The early Christian church seems to have simply taken over the Jewish views about the inspiration of the Old Testament; and, when the New Testament canon was complete, they transferred the same characteristics to the New Testament writings also. It is evident that the early fathers of the church wished to teach that the complete knowledge of the salvation of God revealed in Christ was to be found in the Holy Scriptures because they were the book of God, but it is difficult to gather any consistent doctrine of inspiration from their writings, and when they do speak of inspiration it seems as if they were thinking more of the psychological process going on in the mind of the inspired man than of the result in the character of an inspired book. It was perhaps difficult for men educated in the principles of heathen philosophy to avoid applying their early belief about the pagan *mania* to explain or define the Christian idea of inspiration. At all events we find the doctrine of inspiration described under such metaphors as the Platonists were accustomed to use; the inspired writer was the lyre, and the Holy Spirit the plectrum;

the writer was the vase, and the Spirit filled it; and Montanus could appeal to the almost unanimous idea of the church that prophecy implied both passivity and ecstasy.

The schoolmen accepted the doctrine of inspiration as it came to them from the fathers, and methodized it. They held that the Bible, which was the word of God and therefore inspired, was the source of doctrinal truth; and so this inspiration of the Bible came out in the fact that the doctrinal truths contained in it were infallibly true. The schoolmen also recognized that a revelation which is primarily doctrinal, and that only, requires infallibility in interpretation as well as infallibility in delivery; and so the inspiration of the church was as important as the infallibility of Scripture. As time went on the infallible interpretations were collected, and side by side with an infallible Scripture was the infallible tradition or the official interpretation of Scripture. The logical schoolmen, however, perceived, what was not so distinct to the fathers of the church, who were accustomed to think in pictures rather than in propositions, that if the Bible was altogether a communication of doctrinal truth there was much in the Scriptures which had not at first sight that appearance. The long histories, the tables of genealogy, did not contain doctrinal statements, or give rules of holy living. Were these portions inspired? The question does not require to be raised if we believe that inspiration implies simply that God has fully committed His revelation to writing, and that revelation is above all things God entering into human life and history for the salvation of his people, for then the whole course of the history, with all the facts as well as the doctrines, contains the revelation. But if we take revelation to be only the delivery of doctrines, the question arises and disturbs our theory of inspiration. The fathers solved every difficulty here by appealing to allegorical interpretation, for allegory will turn the driest statistical details into a moral or doctrinal code; but the schoolmen were too dryly logical to be quite content with this explanation. They accepted the allegorical senses of Scripture, but many of them held, like Thomas Aquinas, that there were two kinds of inspiration in Scripture, the *direct*, which is to be found where doctrinal and moral truths are directly taught, and the *indirect*, which appears in historical passages, whence the doctrinal and moral can only be indirectly evolved by the use of allegorical interpretation.

The reformers placed the authority of Scripture above the decrees of popes and councils, above the opinions of the fathers, above the whole digest of official interpretations of Scripture which made tradition. They regarded Scripture as the judge in all controversies in matters of faith and doctrine, and as the source whence came every article of belief; but, besides this, they held that Scripture was a means of grace, a principle of salvation, a means of awakening the new life in the hearts of God's people. This was the real gist of the Reformation doctrine of Scripture; this was the main part in the contribution which the reformers made to the doctrine of the word of God. The fathers had spoken of the practical importance of Scripture and its power for edification, but they had placed these qualities in a secondary position, and in the scholastic period Scripture came to be regarded as little more than a quarry for doctrines. The reformers insisted that all doctrines must come from Scripture; they held that the Scripture was the book of the all-wise God, and was therefore the touchstone in matters of religious controversy; but they also held that above all the Scripture was the sword of the Spirit, and that its main use was to pierce the heart and conscience. **Ac-**

according to the reformers, the revelation of God was fully committed to writing in the Scriptures, and the inspiration of Scripture lay in this fact; but they held that the special nature of inspiration must be derived from the purpose of God in this matter. God fully committed His revelation to writing, they argued, not merely to impart new knowledge to men, but also and principally to awaken His people to a new life; and this purpose must appear in the statement of the doctrine of inspiration. Thus the Reformation doctrine of inspiration, while capable of statement in terms somewhat similar, was really different from the patristic and mediæval theories, and it became more closely allied with the written Scriptures, and paid less attention to the writers. It taught that Scripture, as a whole, and the parts of Scripture looked at as parts of the one whole, were designed to be a means of grace, to awaken a new life in God's people, through the work of the Spirit, and thus the doctrine of inspiration was at once brought into connection with and yet clearly separated from the spiritual illumination shared by all believers. It is allied because both the inspiration of Scripture and the enlightening work of the Spirit in the hearts of believers are parts of the plan of God whereby by His means of grace through the work of the Spirit He gathers believers into His kingdom; it is quite distinct, for by it God wholly commits His revelation to writing, and so makes the Scripture able to appeal with the very power of God to the hearts and consciences of men. In this way the doctrine of inspiration was advanced a stage beyond what it had before reached, and indeed was raised to a higher platform. It was now seen that inspiration secured that the Scriptures should be instinct with God's power for salvation, as well as full of the knowledge which God has pleased to communicate to man. And thus in the hands of Luther, Calvin, and Zwingli the doctrine of inspiration had for its correlative the doctrine of *Testimonium Spiritus Sancti*; the two doctrines supported and explained each other. The second raised the first out of the region of mechanical dictation, the first prevented the second degenerating into a mystical enthusiasm. The reformers were content to leave the doctrine of inspiration without much further definition, but they took the full advantage of the spiritual form of the doctrine to use great freedom with the letter of Scripture. Their successors acted otherwise.

The Protestant scholastics for the most part treated the Reformers' doctrine of inspiration very much in the same way as the schoolmen had treated the doctrine of the fathers. They did not deny the spiritual side of the doctrine; they maintained that Scripture was a means of grace, a power of God to salvation; but they did not bring this side forward much in their discussions about inspiration. They dwelt on the fact that inspiration secured accuracy, rather than on the fact that it brought with it spiritual power. They asked, When Scripture is the word of the all-wise God, what does this imply? And the answers were various. Gerhard held that it implied that the writers were the "pens," the "hands," the "amanuenses" of the Holy Ghost. On the other hand, Cappellus, led by his investigations into the antiquity of the Hebrew points, maintained that the inspiration of Scripture did not necessarily demand perfect accuracy in details; and he declared such accuracy not only did not exist in such editions as we have now, but never did exist, for manuscripts show discrepancies which cannot be explained on the theory of willful or involuntary mistakes of copyists.

The Socinians and certain Arminians, such as Episcopius, who started with the idea that the Bible is simply a communication of knowledge, and so revived the

mediæval idea, also resuscitated the scholastic doctrine of partial inspiration. They did not admit the allegorical method of interpretation, and were therefore compelled to reject the "indirect inspiration" of Thomas Aquinas; but they held that inspiration was only required to communicate knowledge which the writer could not otherwise obtain, and they usually asserted that only the doctrinal parts of the Bible were inspired while the historical were not. Calixtus in the Lutheran Church held a somewhat similar opinion.

In more recent times the doctrine of inspiration has assumed various forms, many of which have but slight connection with either the Reformation or the mediæval theories. All admit that the inspiration of Scripture implies that the revelation of God has been committed to writing.

INSTERBURG, the chief town of a circle in government district of Gumbinnen, East Prussia, is situated at the point where the Angerap and Inster join to form the Pregel, about fifty-five miles east of Königsberg. Population (1890), 18,000.

INSTINCT is a term which does not admit of rigid definition, because, as ordinarily used, the meaning of the term is not rigidly fixed. But for the purposes of scientific exposition from a biological point of view the nearest approach we can make to such a definition is perhaps the following:—Instinct is a generic term comprising all those faculties of mind which lead to the conscious performance of actions that are adaptive in character, but pursued without necessary knowledge of the relation between the means employed and the ends attained. We must, however, remember that instinctive actions are very commonly tempered with what Pierre-Huber calls "a little dose of judgment or reason." But although reason may thus in varying degrees be blended with instinct, the distinction between the two is sufficiently precise; for reason, in whatever degree present, only acts upon a definite and often laboriously acquired knowledge of the relation between means and ends. Moreover, adjustive actions due to instinct are similarly performed by all individuals of a species under the stimulus supplied by the same appropriate circumstances, whereas adjustive actions due to reason are variously performed by different individuals. Lastly, instinctive actions are only performed under particular circumstances which have been frequently experienced during the life history of the species, whereas rational actions are performed under varied circumstances, and serve to meet novel exigencies which may never before have occurred even in the life history of the individual.

All instincts probably arose in one or other of two ways. (1) By the effects of habit in successive generations, mental activities which were originally intelligent become, as it were, stereotyped into permanent instincts. Just as in the lifetime of the individual adaptive actions which were originally intelligent may by frequent repetition become automatic, so in the lifetime of the species actions originally intelligent may, by frequent repetition and heredity, so write their effects on the nervous system that the latter is prepared, even before individual experience, to perform adaptive actions mechanically which in previous generations were performed intelligently. This mode of origin of instincts has been appropriately called the "lapsing of intelligence." (2) The other mode of origin consists in natural selection, or survival of the fittest, continuously preserving actions which, although never intelligent, yet happen to have been of benefit to the animals which first chanced to perform them. Thus, for instance, take the instinct of incubation. It is quite impossible that any animal can ever have kept its eggs warm with the intelligent purpose of hatching out their

contents, so we can only suppose that the incubating instinct began by warm-blooded animals showing that kind of attention to their eggs which we find to be frequently shown by cold-blooded animals. Thus crabs and spiders carry about their eggs for the purpose of protecting them; and if, as animals gradually became warm-blooded, some species for this or for any other purpose adopted a similar habit, the imparting of heat would have become incidental to the carrying about of the eggs. Consequently, as the imparting of heat promoted the process of hatching, those individuals which most constantly cuddled or brooded over their eggs would, other things equal, have been most successful in rearing progeny; and so the incubating instinct would be developed without there having been any intelligence in the matter.

That many instincts must have been developed in this way is rendered evident by the following considerations. (1) Many instinctive actions are performed by animals too low in the scale to admit of our supposing that the adjustments which are now instinctive can ever have been intelligent. (2) Among the higher animals instinctive actions are performed at an age before intelligence, or power of learning by individual experience, has begun to assert itself. (3) Considering the great importance of instincts to species, we are prepared to expect that they must be in large part subject to the influence of natural selection. As Mr. Darwin observes, "it will be universally admitted that instincts are as important as corporeal structures for the welfare of each species under its present conditions of life. Under changed conditions of life it is at least possible that slight modifications of instinct might be profitable to a species; and if it can be shown that instincts do vary ever so little, then I can see no difficulty in natural selection preserving and continually accumulating variations of instinct to any extent that was profitable. It is thus, I believe, that all the most complex and wonderful instincts have originated."

But here it is of importance to note that there is no reason why instincts should be restricted to one or other of these two modes of origin. On the contrary there seems to be every reason to suppose that many instincts may have had, as it were, a double root—intelligent adjustment and natural selection blending their influences to joint production. For example, the grouse of North America display the curious instinct of burrowing a tunnel just below the surface of the snow. In the end of this tunnel they sleep securely; for, when any four-footed enemy approaches the mouth of the tunnel, the bird, in order to escape, has only to fly up through the thin covering of snow. Now in this case the grouse probably began to burrow for the sake of protection, or concealment, or both, and if so, thus far the burrowing was probably an act of intelligence. But the longer the tunnel, the better would it have served the purpose of escape; and therefore, natural selection would almost certainly have tended to preserve the birds which made the longest tunnels, until the utmost benefit that length of tunnel could give had been attained. And similarly the origin of many other instincts may be satisfactorily explained by thus supposing the combined operation of two causes—intelligent adjustment and natural selection—where there is a difficulty in explaining their origin as due to either cause alone. And if even in fully formed instincts we often find "a little dose of judgment or reason," we can have no cause to doubt that in the formation of instincts by natural selection, such small admixtures of judgment or reason may often greatly assist the process, while, conversely, it is even more evident that an instinct which is developing from the habitual performance of an intelligent action might be greatly

assisted by natural selection favoring the individuals that most frequently or most promptly performed that action.

INSTITUTE OF FRANCE, an association constituted under the name of the *Institut National* by the French Republican Convention, in October, 1795, to occupy a similar position to that of the old academies suppressed by an act of the Convention, April 8, 1793. The affix to the word "Institut" has undergone a variety of changes corresponding to changes in the form of the government of France. The Institute owed its existence chiefly to the efforts of three persons, Lakanal, Daunou, and Carnot, and, according to the terms of the law by which it was founded, its purpose was to "advance the sciences and arts of research by the publication of discoveries and by correspondence with other learned societies, and to prosecute those scientific and literary labors which shall have for their end general utility and the glory of the republic." It was composed of three classes—the first for sciences physiques et mathématiques, the second for sciences morales et politiques, and the third for littérature et beaux-arts. Originally it consisted of one hundred and forty-four members (the forty-eight nominated by the Convention electing ninety-six others), an equal number of associates in the provinces, and twenty-four foreigners of distinction who held the position of correspondents. Each class was divided into several sections, six members and six associates being assigned to each section. The first class was composed of ten sections, viz., (1) mathématiques, (2) arts mécaniques, (3) astronomie, (4) physique expérimentale, (5) chimie, (6) histoire naturelle et minéralogie, (7) botanique et physique générale, (8) anatomie et zoologie, (9) médecine et chirurgie, (10) économie rurale et art vétérinaire. The second class was composed of six sections, namely, (1) analyse des sensations et des idées, (2) morale, (3) science sociale et législation, (4) économie politique, (5) histoire, (6) géographie. The third class consisted of eight sections, viz., (1) grammaire, (2) langues anciennes, (3) poésie, (4) antiquités et monuments, (5) peinture, (6) sculpture, (7) architecture, (8) musique et déclamation. To the first class were thus assigned sixty members and as many associates, to the second thirty-six, and to the third forty-eight, the foreign correspondents being divided equally among the classes. No member was permitted to belong to more than one class; but any one might be present at the meetings and assist in the labors of the other classes. The Institute was installed at the Louvre in the building formerly occupied by the Académie Française, but in 1806 its locality was changed to the Collège des Quatre-Nations. The First Consul on January 23, 1803, decreed for it a new constitution, the leading features of which were—that the approval of the head of the government was essential in the election of members; the suppression of the second class; and a redivision into the four classes of (1) sciences physiques et mathématiques, (2) la langue et la littérature Françaises, and (3) histoire et littérature anciennes, (4) beaux-arts. The first class was composed of the ten sections of the old first class, and an additional section of geography and navigation with three members, with power to nominate one hundred correspondents. The second class was composed of forty members not separated into sections. The third class was composed of forty members and of eight foreign associates, and had the power to nominate sixty correspondents. The fourth class, which was composed of twenty-eight members and of eight foreign associates, was divided into five sections—peinture with ten members, sculpture with six, architecture with six, gravure with three, and musique (composition) with three members. It had the power to nominate thirty-six correspondents. All

classes had power to elect a stipulated number of members from the other classes. After the Restoration Louis XVIII., on March 21, 1816, decreed the revival of the names of the old academies to the four classes of the Institute:—(1) L'Académie Française, corresponding to the old second class; (2) L'Académie royale des inscriptions et belles lettres, corresponding to the third class; (3) L'Académie royale des sciences, corresponding to the first class; and (4) L'Académie royale des beaux-arts, corresponding to the fourth class. On March 5, 1833, a fifth academy was added to the Institute—L'Académie des sciences morales et politiques, corresponding to the second class suppressed by Napoleon. As restored, it was composed of thirty members, with a minimum of thirty and a maximum of forty correspondents. It was divided into five sections, viz., (1) philosophie, (2) morale, (3) législation, droit public et jurisprudence, (4) économie politique et statistique, (5) histoire générale et philosophique.

INSURANCE is the system or machinery by which it is sought to guard against the pecuniary consequences of certain accidents to which men are liable, such as the loss of property by fire or shipwreck, or the loss of future earnings through disablement or premature death. Insurance does not attempt to prevent these accidents, nor even to protect men against all the consequences of them. It deals only with the main pecuniary loss which such accidents are fitted to occasion, provides for it beforehand, practically distributes it among the persons who are more or less exposed to the same risk; and so, when the accident does light on any one of them, its pecuniary effects are neutralized or greatly mitigated. The three chief developments of this system—Fire, Life and Marine Insurance—are separately treated in the following articles. A very important application of the principle has been treated under the heading FRIENDLY SOCIETIES.

Besides the above branches of insurance, which have attained immense proportions in almost all civilized countries, there are many other applications of the principle which have been tried with greater or less success. The conditions which seem necessary to success (in addition to good administration) are chiefly these:—There must be a risk of real loss which it ought to be beyond the power of either the insurer or the insured to avert or to hasten; a large number of persons must be liable to the like risk; the accident contemplated must be likely to fall on a comparatively small number of the persons exposed to the risk of it; the probabilities of its occurrence must be capable of being estimated beforehand with some approximation to certainty; the loss apprehended must be so considerable when it does occur as to be worth providing against; and the cost of that provision must be comparatively so small as not to be prohibitive.

Ordinary life insurance protects against the pecuniary loss arising to a man's family or creditors or others by his death, whether that arise from accident or disease; but it has been found that a separate insurance against the consequences of accident meets the requirements of a large class of persons. A company was established in London in 1849 for insuring against the consequences of railway accidents—the Railway Passengers' Insurance Company. Many other similar companies have since been established, and at the present time (1890) there are several such offices in Great Britain.

The business of insuring against accidents has been developed in Canada, Victoria, and New South Wales, as well as in France, Germany, Switzerland, and the United States. In this country the premium income of the principal office engaged in this business was, in 1889, over \$1,000,000.

The guarantee of employers against the fraud or insolvency of their servants has of late years become a considerable and useful department of insurance business. Private suretyship is attended by many evils, and a bond of indemnity by a joint-stock company, although it has to be purchased by a yearly payment, is now generally preferred. Such a bond is not granted without previous inquiry as to the character of the applicant and the checks which the employer is to use.

In those parts of the United States and elsewhere which are exposed to violent hailstorms offices have been established successfully for insurance against the loss which these often occasion. Efforts have been made also, not always with equal success, to protect farmers and other owners of horses and cattle against the loss arising from accident or disease among these animals. It has been attempted also to insure traders against the loss from bad debts, and house-owners against loss of rent and against defective titles.

Fire insurance is a matter of practical interest to a far larger number of persons than either of the other two great departments of insurance—life or marine. There are few persons to whom, in the absence of insurance, the destruction of their dwellings or of their household goods would not be a serious calamity, while to the merchant or manufacturer the burning of his premises or stock or machinery might be ruinous. No age or country has been exempt from such fatalities, and no watchfulness has been able to prevent them. Some protection against the pecuniary consequences seems an essential condition of any extended system of manufactures or commerce.

Fire insurance, however, as an organized system, has an origin comparatively recent. There are traces, indeed, in earlier times of forced or voluntary contributions toward the relief of sufferers by fire, but it is only about the beginning of the seventeenth century that we hear of proposals being made for a more systematic provision, and it was not till after the great fire of London in 1666 that these proposals took practical shape. This seems at first to have been in the form of underwriting by individuals or by clubs, and some attempts were made to engage the corporation of London in a scheme of fire insurance; but in 1681 the first regular office for insuring against loss by fire was opened by a combination of persons "at the back-side of the Royal Exchange," and it was followed shortly afterward by another. Of the insurance offices that still survive, only one, the Hand-in-Hand, dates from the seventeenth century (1696); five date from the first half of the eighteenth century, the Sun (1710), Union (1714), Westminster (1717), London (1720), and Royal Exchange (1720); while only three date from the second half of that century, the Salop (1780), Phoenix (1782), and Norwich Union (1797). The first fire office in Scotland was established in 1720, the first in Germany in 1750, and the first proprietary company in that country in 1779; the first office in the United States was established at Philadelphia in 1752, one of its early directors having been Benjamin Franklin; the first in France dates from 1816, and the first in Russia from 1827.

Fire insurance as a business consists in undertaking a certain risk more or less considerable in amount, in return for a comparatively small sum, received beforehand, called the premium. While the amount of risk undertaken is strictly limited to the sum insured, the degree of risk is an element extremely difficult to measure, and liable to much fluctuation. Whether of ten thousand houses or shops, or stores, or factories, ten or a hundred will be more or less injured every year by fire is a matter partly of experience, but partly also of conjecture and, as we say, of chance. Assuming

that the proportion would always be the same under precisely the same circumstances, not perhaps every year but on an average of years, the questions remain whether the circumstances will always be the same, and whether, if they be, the one thousand cases on which we have made our own calculations are a sufficient basis for dealing with ten thousand cases. The slightest observation reveals an endless diversity in the risks undertaken, and, even if an absolute law could be reckoned on, the risks would require careful and accurate classification before the law could be deduced. But, in point of fact, the risks are always changing. If we take what from an insurance point of view is the simplest and safest "risk," a private dwelling house in a large town, the question suggests itself:—How has this risk been affected by the age of the building, the character of the occupants, the introduction of gas or paraffine or lucifer matches, by the proximity of more dangerous property, and by the improvement or deterioration in the public supply of water and the public arrangements for extinguishing fires? Infinitely greater changes take place in the degree of risk attending warehouses and manufactories, and many of these developments are of an unexpected character. The great fire in Tooley street, London, in 1861, was aggravated by a prodigious escape of burning tallow, which literally set the Thames on fire, and long defied all efforts to extinguish it. More lately at Leith a highly inflammable spirit recently introduced into trade exhibited similar characteristics. At Newcastle a fusion of nitrates of soda or potash mixed with burning timbers caused a prodigious aggravation of a fire; and at Glasgow and elsewhere the fine flour dust of a corn mill, when mixed with a certain quantity of atmospheric air, was unexpectedly found to be as explosive as gunpowder.

But the speculative hazard of fire insurance as a commercial enterprise is limited by a very important circumstance. The contracts, in the United Kingdom at least, are seldom made for a longer period than one year, and often for less, and need not be renewed on either side unless their safety and reasonableness are confirmed by experience, so that from day to day the insurance company is able in a measure to revise its terms, and to correct the errors arising from imperfect data or a too sanguine generalization. The business on the whole has been a profitable one. The conditions of the contract between a fire office and the insured are regulated partly by the terms of the document known as the policy, which embodies them, and partly by law outside these terms, resulting from custom, from statute, or from legal decisions.

The adjustment of a loss when a fire occurs is not unattended with difficulty, even where there are no such complications as those just referred to. To ascertain the quantity, the quality, and the value of property injured, and the degree of injury, is often a work of no little anxiety. Its destruction has swept away the readiest proof which could have been given; or, where partial damage only has been sustained, it is often scarcely capable of exact measurement. The insured is naturally bound to state and prove his claim; and the office, while exposed on the one hand to exaggerated and even to fraudulent demands, may on the other endeavor to exact from an honest claimant details and evidence which it is scarcely possible for him to give. Fortunately for both parties to the contract, there are strong motives on either side tending toward a reasonable adjustment. In most cases the office is guided by the advice of an independent professional valuer, who, while attending to the interests of his employers, has a natural desire, even apart from his instructions, to conciliate the claimant, and to avoid landing the company he represents in troublesome

controversies. Claims which cannot be adjusted in this way are usually submitted to arbitration, and it is a condition of most policies that both sides must refer the quantum of loss to an arbiter or arbiters. Few claims find their way into the courts of law, and those only where some principle is involved, or where the claim is thought to be fraudulently overstated, or where the still more serious objection is taken that the fire has been the willful act of the insured.

Many troublesome questions are rendered more easy of solution by the condition that it is in the power of the company to reinstate property rather than to pay the value of it. The insured has not the option of requiring reinstatement. In general an office prefers to settle a claim by payment in cash, but an offer to reinstate may be a convenient as it is a perfectly fair reply to an exaggerated demand, and may adjust the pretensions of competing claimants. The insured is not entitled to "abandon" his property, and the company is not bound to take on itself the care or risk of damaged property; it is for the insured to make the most of the "salvage," and to deduct the value of it from his claim, but in practice it is sometimes found desirable to relieve him of this duty.

A part of the insurance system which has developed into great magnitude is the practice of reinsurance. No one company, however large its resources, deems it prudent to undertake a risk to an unlimited amount in connection with any one set of goods or one locality. An office might restrict its liabilities by refusing to insure to a larger amount than what it pleased to run the risk of, but the convenience of the insured and the interest of its own agents, to say nothing of other considerations, make it difficult for any office so to limit its responsibilities. It therefore issues a policy for the amount proposed to it, but reinsures a part with some other office or offices. Business to a very large amount is exchanged in this way, and there are some offices which professedly, and some which practically, live by the premiums paid over to them by other offices.

What has been said hitherto has had reference chiefly to one side of the fire insurance contract—the obligations undertaken by the company. The consideration they receive in return is the payment made by the insured called the "premium." The premium is calculated at so much per cent. of the sum insured, and is usually paid once a year; but many insurances are effected on mercantile property and on ships for periods less than a year—ten days, one, three, or six months—the rate in such a case being higher than an aliquot part of the yearly rate; and insurances may be effected for seven years by a payment of six times the yearly rate, and for other periods at a proportionate discount. Insurances effected for a year, and stated to be renewable, practically remain in force for fourteen or fifteen days after the expiry of the year; that is, they may be renewed by payment of the premium within these "days of grace," and if a fire occurs in the meantime the company will be liable. This will not happen, however, if an intention not to renew has been manifested on either side.

We may suppose the question to arise:—What ought to be paid for insuring a cotton mill, or a flax or woolen mill, or a weaving factory, or a wharf or warehouse in some large city? The experience of any one office scarcely affords adequate data, and a rate based on the combined experience of many offices has a greater chance of being at once safe and fair. The problem, indeed, is a more complicated one than what has been already said would indicate. The property to be insured may consist of several distinct buildings, and the contents of them: one building may be devoted to operations involving in a high degree the risk of fire; in another the processes

carried on may be more simple and safe; a third may be used only for the storage of materials having little tendency to burn. These several buildings may be more or less connected with each other—under the same roof, under different roofs, but with internal communications, contiguous, but without any communications, detached, but still within reach of fire. Of two mills one may work on fine materials, the other on coarse; in one the machinery may be driven twice as fast as in the other; in one the most hazardous processes may be carried on in the heart of the building, in the other they may be so treated and so guarded as to involve the rest of the property in no peculiar danger. Fairly to measure these various hazards it has been found necessary that the experience and skill at the command of many companies shall be combined, and that the rates shall be the result of consultation and a common understanding.

Now, it is clear that no office will contribute its skill and experience to such a common stock if the effect is to be that other offices may avail themselves of the information in order to undersell it. Consultation about rates, and a common understanding, necessarily involve a reciprocal obligation to charge not less than the rates thus agreed on; in other words, a tariff of rates is developed to which each office binds itself to adhere. The system tends to restrain and moderate the competition for business which inevitably, and to some extent, properly exists among the companies, and its value to them is manifest. But it is also of service to the insuring public. At first sight it might seem that free competition would suit the public best, and that a combination among the offices must tend to keep up rates, and to secure for the companies excessive profits, but a little consideration will show that this is a mistake.

It is an unquestionable truth, though one often lost sight of, that all losses by fire must ultimately be borne by the public. The insurance companies are the machinery for distributing these losses, nothing more. If the losses fell on them, their funds, large as they are, would speedily be exhausted, and the service which they render to the public would come to an end. To those who require insurance against loss by fire, it must be a manifest advantage that they should have many sound and prosperous offices ready to accept their business, and no less able than desirous to earn or to retain the public favor by fair and liberal conduct. A necessary condition of this state of things is that the rates of premium paid for insurance should be remunerative to the offices, and the main object of the tariff system is to secure such remunerative rates.

This it endeavors to do by two methods—by an agreement as to what rates are to be charged, and by affixing such a penalty to dangerous constructions, substances, and processes as to induce, if possible, a lessening of the danger. In other words, and reversing the order, it seeks to diminish the risk of fire, and to secure adequate payment for what risk remains. There can be no doubt as to the benefit the public derive from the former of these, in having pointed out to them, not on the authority of one office, still less on hesitating and contradictory authority, but with all the weight arising from the combined experience of numerous companies, that this or that method of construction, this or that combination of materials, this or that mode of conducting a manufacturing process, is attended by imminent hazard of fire, and in having the lesson enforced by a heavy pecuniary penalty. On the supposition that the offices are correct in their estimate of risks, the effect, and indeed the intention, of their rule is not so much to put money into their own coffers as to lessen the danger, and to save themselves in the first instance, and the owners of

property ultimately, from the consequences of preventable fires.

The general principles and practice of fire insurance are, in their main features, the same in most parts of the world. In the United States the business has been pursued with characteristic energy, and with some peculiarities of law and practice. As already stated, the earliest American fire insurance company was organized in 1752, and its policies during the first year covered a sum of \$108,360 at an average rate of 1.17 per cent. Each State of the Union has its own regulations about insurance companies, its insurance department, its insurance commissioner, superintendent, or auditor, its system of accounts and checks and public notices, its fees, taxes, and requirements as to deposits. The trouble and expense to which offices are thus exposed, especially where they do business in many States, is very great indeed, while the resulting benefits are problematical. All attempts of this sort are attended with these disadvantages, that they interfere injuriously with honest and well-conducted companies, and afford but a feeble protection against those of a different class; that they involve the government in the odium of failures which it is supposed to be its duty to prevent; that they lessen the sense of responsibility among those who control the offices, and the spirit of prudence and watchfulness among the public; and that they place in the hands of public officials a power and influence which are apt to be abused, and are always open to suspicion. More to be admired and imitated are the State regulations in America with respect to building operations, the extinguishing of fires, and the inquiring into their origin. The business of an insurance agent in America is more recognized than in England as a distinct profession, and the agent is intrusted with greater powers. More has been done to facilitate the working of insurance by the surveying and mapping of large cities, and there has been a greater development of periodical literature devoted to the subject.

Since 1866 a national board of fire underwriters of the United States has existed, and has proved of great service to the insurance offices and to the public.

In France there were at a recent date thirty-two proprietary and about twenty mutual fire-insurance offices. Of the thirty-two offices founded on capital three are provincial offices, and the others are established in Paris. Two confine themselves to reinsurance. From the returns made by twenty-three of these offices, including all the more important, it appears that their income from premiums is about 92,000,000 francs, and their losses 47,000,000. The average loss during eleven years was 50 per cent. of the premiums. Many of the French offices have been extremely successful; and recently there has been a remarkable increase of new offices in that country.

In 1889 the stock companies reporting to the New York insurance department numbered 153, of which twenty-two were branches of foreign (European) companies. The home companies had assets amounting to \$168,727,358, a capital of \$60,132,620, and a surplus of \$40,760,990. Their total income for the year was \$77,206,692, and they paid out for losses \$43,931,408. The foreign companies showed assets of \$44,862,466, a total income of \$30,411,440, and paid for losses \$19,296,991. The risks carried by the combined companies amounted to \$13,678,732,014.

The system of life insurance embraces a variety of contracts by which the insurers engage to pay capital sums on the decease of policy-holders or nominees, in consideration of other sums received during their lifetime. These contracts may be divided into two classes—(1) those in which the sum insured is certain to be

come payable, provided only the insurance is duly kept in force, and (2) those which are of a temporary or contingent character, so that the sum insured may or may not become payable according to circumstances.

To the first of those classes belong the great bulk of the transactions of life insurance offices, namely:—

1. *Whole-Term Assurances on Single Lives.*—These are simply contracts on the part of the insurance office to pay a certain sum (with or without “bonus additions,” as the case may be) on the death of the person named in the policy, whenever that may occur. The premium, or consideration for the insurance, is in most cases an annual sum payable during the whole continuance of the policy. It may, however, be arranged in various other ways—as, for example, by a single payment at the commencement of the transaction; or by a limited number of contributions, each larger in amount than the annual premium for the whole of life; or by payment of a modified rate during a limited period and a correspondingly higher rate thereafter. Insurances for the whole term of life are more common than any other kind.

2. *Endowment Assurances.*—Next to insurances for the whole term of life, these constitute the most numerous class of insurances on single lives. The sum insured is payable to the person named in the policy, if he should survive a certain period or attain a specified age, or to his representatives at his death, if that should occur before the time expired.

3. *Insurances on Joint Lives.*—In these transactions two or more lives are included in the policy, and the sum insured is payable when either or any one of them fails.

4. *Longest-Life Insurances, or Insurances on Last Survivor.*—These also are effected on two or more lives, but, instead of falling in by the death of any one of the parties, they do not mature until both or all are dead.

The second class of insurances described above consists principally of two kinds:

1. *Temporary or Short-Period Insurances.*—These are effected for limited periods to cover special contingencies, the sum insured becoming payable only if death should occur within the time specified in the policy. Such insurances may be effected on single lives or on two or more lives, and (in the latter case) may be payable either if one life or all the lives should fail within the period, or only if one life should fail before another, as in the case to be next mentioned.

2. *Survivorship Insurances, or Insurances on one Life Against Another.*—In these the sum insured is payable at the death of A if that should happen in the lifetime of B, but not otherwise. Should B predecease A, the transaction falls to the ground.

Besides these there are transactions of other kinds dealt in by life-insurance offices—such as deferred insurances, where the risk does not commence until the expiry of an assigned period; deferred and survivorship annuities; insurances against issue, for the benefit of expectant heirs; and the like. The system is indeed adapted to nearly every contingency of a pecuniary nature connected with human life.

It may be observed that, while life insurance has much in common with fire and marine insurance, there are some essential differences between it and them. The insurance of houses and goods against fire, or of ships and merchandise against the casualties of the sea, is a contract of indemnity against loss, and in like manner an insurance on human life may be regarded as indemnifying a man's family or his creditors or others interested against the loss of future income by his premature death. But it does not necessarily take the value of

such income into account, nor does it relate to any intrinsic value of the *subject* of the insurance—the life of the insured party. Again, in fire and marine insurance loss may be either total or partial. In life insurance the event insured against cannot take place in any limited degree, and there is thus no partial loss. And again (in the first and larger of the two classes into which life insurances are divided) the event is certain to occur, and the time of its happening is the only contingent element. In the other kinds of insurance the events are wholly of a contingent character.

Calculations of Premiums.—The general principles of life contingency calculations are explained in the article ANNUITIES, and it is there shown that such calculations are made by means of mortality tables, which exhibit the numbers of persons who out of a given number born or living at a particular age live to attain successive higher ages, and the numbers of those who die in the intervals. An account of the numerous tables of this kind which have been framed from time to time does not fall within the scope of the present article.

In the United States, life assurance has attained a greater relative importance among financial institutions than in any other country. Its history extends back to an early period, but the system has received its main development in comparatively recent times. During the years which immediately followed the close of the civil war it grew with unparalleled rapidity. The social disorders of the period excited anxiety for the future, and directed earnest attention to institutions which promised exceptional security. The general government, by its financial administration, and especially by its issue of paper money, furnished a powerful stimulus to the speculative tendency in this as in every branch of business. New companies were established in great numbers; new plans and features of assurance contracts were devised; thousands of energetic agents canvassed the community with their solicitations; and the published reports of the assurance companies reflected, in a high degree, the fictitious prosperity of the period of inflation. The financial crisis of 1873 applied to the companies a test of great severity. The mushroom institutions of recent growth fell rapidly; and, while the standard societies, which were administered with wise conservatism, and which had always held the greater part of the business, were unshaken, their growth was seriously checked.

The *Insurance Year-book*, issued by the Spectator Company, gives the aggregates of life insurance in the United States in 1888 as follows:

Premium receipts.....	\$121,326,384
Total income.....	156,071,347
Payments to policy-holders.....	77,540,471
Expenses of management.....	29,554,897
Assets.....	652,610,395

On January 1, 1889, there were in force 3,884,285 policies, representing \$3,200,467,497 of insurance.

A subject of special interest in connection with life assurance in America is the legislation by which it is regulated. While the national government, under the constitution of the United States, has supreme control over all commerce between the States, the courts hold that insurance in its various forms is not commerce, and that corporations created by a State have no corporate powers beyond the limits of that State, and can transact no business beyond those limits, except on sufferance of the local government. Hence the life-assurance companies are the creatures of State law, and are controlled by the legislatures of the States in which they operate. The first systematic attempt to regulate the business by government supervision was made by the State of Massachusetts under a statute passed in 1858 establish-

ing an "insurance department." New York adopted a similar law in 1859, and the example has since been followed in nearly all the States, even in those which have no important assurance companies of their own. Each State has its own peculiar laws, and these undergo frequent changes in detail as successive legislatures attempt to improve or to reform the business, but the general character of the supervision exercised is the same in the different States, and is as follows: A company may be organized at any time for the business of assuring lives and granting annuities, by obtaining from the proper officers of the State the approval of its name and fundamental law or charter, and by depositing with the insurance department a stated sum, usually \$100,000, in prescribed securities, as a guaranty of good faith.

In New York and some other States the insurance department may receive further deposits, representing the reserve or present value of policies, and hold them accumulating in trust, for the security of those particular policies, which are "registered" in the State treasury. This scheme was pressed with vigor a few years ago, as offering peculiar protection, but several companies which adopted it have failed, and the settlement of the claims of creditors upon the funds held by the State has been the cause of much delay and costly litigation.

In each State there is a superintendent or commissioner of insurance whose powers and duties toward the companies are varied and important. The companies must return to him under oath every year full statistics of their business in all departments, showing the precise investments of their funds, the amount and sources of their income, the expenditure for every purpose, and a schedule of policies with the elements for valuing them. It is the superintendent's duty to see that the investments are made in accordance with the laws, which limit the companies to securities popularly regarded as the safest; to make every inquiry which he deems it "desirable for the public interest" to have answered; to make a valuation of the policies of each company by the legal standard; and to report to the legislature every year in full the results of his inquiries and calculations. It is his duty, "whenever he shall deem it expedient so to do," and in particular whenever he shall suspect any statement made by the officers, to "investigate" the affairs of each life insurance company—that is, to overhaul its books and accounts, examine its muniments of title, and test and scrutinize every part of its administration. No company chartered by any other State or government can do any business within the State, except under his license and certificate that it has complied with all the laws; and exclusion from the State is the penalty for neglect to answer any question concerning its business which he may ask. In several States he is required to exclude any company which shall take an appeal from the courts of the State to a court of the United States, in a case arising between it and a citizen.

The most important duty imposed on the superintendent is the administration of the legal test of solvency. In New York and most of the other States, his valuation, according to the legal standard, must be made by the net-premium method, and if any company is unable to meet this test by actual possession of the requisite amount of funds, he must commence legal proceedings for its dissolution, and the distribution of its assets as in bankruptcy. The act making this course imperative in New York was passed in 1879, but many years earlier the practice had become fixed of requiring a company to meet a net valuation of its obligations, or be deemed insolvent. The fairness of this unbending application of the net-premium mode of valuation as a test of mere solvency, and the efficiency of the check

supplied by a too exclusive reliance on such a test, have often been called in question.

When an insolvent assurance company is wound up, the rule commonly followed by the courts of equity in distributing the proceeds is to recognize each policy-holder as a creditor for the amount of reserve corresponding to his assurance at the time of the declared insolvency. The representatives of a policy-holder who dies before the actual distribution may claim for the amount of the policy, discounted back to the date of insolvency. The whole process of winding up would be much more satisfactory than it has proved, if the courts and the departments could make a prompt and inexpensive distribution. But in practice there is too much danger of the distribution being delayed until the available assets have been largely dissipated in receivership and legal expenses.

In New York, and several other States, the legislature has interfered to prevent the forfeiture of assurances by the failure to pay a premium, and has undertaken to regulate the payment of surrender values and the grant of paid-up policies in such cases. There is not, however, any general agreement among the different States as to the basis on which such allowances are to be computed. It is too soon to judge finally of the effect of these non-forfeiture laws upon the business; but the impression is believed to be growing among thoughtful policy-holders that they are too favorable to withdrawing members, and tend to weaken the companies, by encouraging the retirement of the most healthy and profitable lives. Laws of this kind usually proceed upon the theory that the reserve for each particular assurance is to be looked upon as in some sense the property of the individual policy-holder.

Some years ago the Chamber of Life Insurance in America (an association formed among the American assurance offices) undertook the collection and arrangement of the experience of a number of the companies in the States.

An interesting feature in the practice of many American offices is their dividing profits on the "contribution method," so called because it aims at returning to each class of policy-holders a share of the surplus proportionate to the amount contributed to its formation.

Marine insurance is a contract by which one party, the "insurer" or "underwriter," engages for a stipulated premium to protect another party, the "assured," against loss arising from certain perils, or sea risks, to which his ship, goods, or other interest may be exposed during a specified voyage or period of time.

The policy of insurance, or instrument which contains the contract, is a printed form, with spaces left blank for the insertion in writing of the particulars of the agreement. The form in general use appears to have been introduced with the earliest practice of British marine insurance. Although worded in a confused and ambiguous manner, its meaning has been clearly defined by a series of legal decisions on the debatable points; and in all cases the written conditions overrule any of the printed clauses that might seem inconsistent with them.

In practice it is usually desirable to conclude an agreement for insurance at once, lest some subsequent intelligence should induce either party to recede; and it is customary for the underwriter to sign a "slip," or short memorandum of the insurance, until the stamped policy can be completed. But such memorandums, however obligatory in good faith, are not legally binding. The assured, however, is under no obligation to communicate to the underwriter a material fact coming to his knowledge between the date of the slip and that of the policy. And, when a valid policy exists, the slip

is admissible in evidence to throw light on the circumstances under which the risk was offered and accepted.

A valued policy is one which contains a specific valuation of the interest insured. This valuation forms an essential element in the adjustment of all claims under the policy, and cannot be set aside except on the ground of fraud. The burden of proof, in any averment of fraudulent over-valuation, lies on the underwriter.

An open policy is one in which the value of the interest insured is not specified. In claims under such policies the assured must prove the value of the thing insured. The value of a ship for insurance is what she is actually worth at the commencement of the voyage, including all her stores, provisions, and outfit, money advanced for seamen's wages, and costs of insurance. The difficulty of *proving* a precise value in the case of ships is sufficiently obvious; and, to avoid disputes, policies on them ought always to be valued, as is the usual practice. The value to be proved under an open policy on goods is their first cost, including the expenses of shipment, with any portion of the freight that may have been prepaid, and the costs of insurance. The value to be proved in open policies on freight is the amount of the manifest or freight list, excluding such freight as may have been paid in advance.

When the value proved under an open policy falls short of the sum originally insured, the difference, which is technically termed an over-insurance, is treated as a deduction to be made from the amount of the policy. On this footing a proportionate part of the premium is returnable to the assured, who, on his part, can make no claim on the underwriter for loss or damage beyond the value of his interest as actually proved. If, on the other hand, the value proved exceed the amount of the policy, the assured is regarded as "his own underwriter" to the extent of such excess; and the amount of loss or damage, if such has arisen, is apportioned on this footing between the parties relatively to their several proportions of the total value.

A "short interest" arises when only a part of the interest insured has been exposed to risk, as when some portion of the goods specified in the policy have not been loaded on board of the ship. This case is treated in the same manner as that of over-insurance, from which indeed it does not essentially differ.

Double insurance takes place when the same interest has been insured twice or oftener. This frequently occurs, either through mere inadvertence, or from the want of definite information on the part of the respective persons concerned in the transaction. In such cases, the usual practice is that all the underwriters make a return of premium, in proportion to the amounts of their respective subscriptions, for the excess of the sum insured above the actual value of the interest—the liabilities of the several underwriters under the different policies being of course proportionally diminished. To this rule, however, there are two important exceptions. One of these occurs when two or more persons insure the same thing, in order to protect the distinct interests which they may individually have in it; the other, when the circumstances are such that a claim for loss might have been brought against one set of underwriters before the other set had become liable at all.

The risk on the ship, in voyage policies, commences "at and from" the place specified in the policy, and continues till she arrive at the destination specified, and shall have been there moored twenty-four hours in good safety. On goods the risk begins with their loading and ends with their discharge at the specified ports. On freight the risk usually commences with the shipment, and terminates with the landing of the goods; but if there be a contract of affreightment, under which the

goods have been provided for shipment, the risk is held to commence as soon as the ship is in readiness to take them on board. After the risk has once commenced, the whole premium is earned, even although the voyage should not be prosecuted, and the actual risk of the insurers be thereby confined to the mere lying of the ship at the port where the insurance was to commence. But if the risk should not commence at all, or, in technical phrase, if the "policy should not attach," the premium must be returned to the assured.

If the ship should deviate from the regular and usual course of the specific voyage insured without necessity or reasonable cause, the underwriter is thenceforth discharged from all liability under the policy. The insurance becomes void as soon as such deviation begins; and consequently it is quite immaterial whether a subsequent loss of the ship should happen during the actual deviation or after the ship had returned to her course, the insurer being no longer concerned. It is also immaterial whether the assured was or was not cognizant of the deviation. A mere intention to deviate will not vitiate the policy; but if the ship has sailed on a different voyage from that specified, the insurer is discharged although the loss should happen before reaching the point of divergence in the two voyages. An unjustifiable delay in the prosecution of the voyage operates as a deviation. The causes which justify deviation are such as to refit the ship after she has been disabled, to avoid an enemy or an impending storm, or to save the lives of seamen in distress.

In all voyage policies it is an implied condition of the contract that the ship shall be seaworthy at the commencement of the risk. By this is meant that the ship shall be in a fit state, as to repairs, equipments, crew, and all other respects, for encountering the ordinary perils of the voyage insured at the time of sailing on it. Seaworthiness is a condition precedent to the contract; and, therefore, where the ship is originally unseaworthy, the underwriter is discharged even although the loss should result from causes independent of the particular deficiencies constituting the unseaworthiness.

The contract of insurance being preëminently one based on the assumption of perfect good faith between the parties, it is the duty of the party wishing to effect the policy to make a true disclosure of every circumstance likely to affect the underwriter's estimate of the risk. The concealment or misrepresentation of material facts, or the representation of anything not consistent with the facts, will render the policy void. This rule holds good even where the concealment or misrepresentation may have resulted from a mistake, without the intention to deceive.

The perils insured against are described in the printed form as the "adventures and perils of the seas, men-of-war, fire, enemies, pirates, rovers, thieves, jettisons, letters of mart and counter-mart, surprisals, takings at sea, arrests, restraints, and detainments of all kings, princes, and people, of what nation, condition or quality soever, barratry of the master and mariners, and all other perils, losses, and misfortunes that have or shall come to the hurt, detriment, or damage of the said goods, merchandises and ship, etc., or any part thereof."

Losses resulting from breaches of the revenue laws or of the law of nations, or from illegal voyages generally, are not covered by the policy. The risk of "thieves" applies only to plunder committed by open violence, and does not cover losses by secret theft. The illegal acts of the master and crew, if committed without the privity of the owners, will amount to barratry, so as to render the underwriters responsible for them;

but if the master be also owner of the ship, none of his acts will be held as barratrous.

The printed form of the policy declares that "in case of any loss or misfortune it shall be lawful to the assured, their factors, servants, and assigns, to sue, labor, and travel for, in, or about the defense, safeguard and recovery of the said goods and merchandises, or ship, or any part thereof, without prejudice to this insurance: to the charges whereof, we, the assurers, will contribute, each one according to the rate and quantity of his sum herein insured." The object of this clause is to permit the assured to take measures for the recovery of the property without losing any right of abandonment he might have in the circumstances. Although the language of the clause is only permissive, it is a settled rule that the assured is bound so to labor for the recovery of the property. The best practical rule for the assured to follow in cases of partial loss or damage is to act in the circumstances as a prudent man would do if uninsured.

An important clause in the printed policy is what is called the "memorandum," which is as follows: "Corn, fish, salt, fruit, flower, and seed are warranted free from average, unless general, or the ship be stranded. Sugar, tobacco, hemp, flax, hides, and skins are warranted free from average under 5 per cent. And all other goods, also the ship and freight, are warranted free of average under 3 per cent., unless general, or the ship be stranded." The effect of this clause, as interpreted by legal decisions, is to free the underwriter from claims for particular average (or partial damage), or from such claims if under the rates specified, unless the ship be stranded. But if the ship be stranded, he is liable for such claims, whether caused by the stranding or not. For losses of the nature of general average the underwriter is liable whether the ship be stranded or not, and whether the amount be over or under the rates mentioned in the memorandum.

INTERDICT, in its full technical sense as an ecclesiastical term, means a sentence by a competent ecclesiastical authority (popes, councils, bishops with chapters) forbidding all administration of the sacraments, celebration of public worship, and use of the burial service. An interdict may be either local, personal, or mixed, according as it applies to a locality, to a particular person or class of persons, or to a particular locality as long as it shall be the residence of a particular person or class of persons. Local interdicts again may be either general or particular; in the latter instance they refer only to particular buildings set apart for religious services. In the writings of Augustine there is an indication that something of the nature of an interdict had been attempted in his diocese by a certain bishop Auxilius; the attempt is strongly condemned by Augustine, who disapproved of the plan, as making the innocent suffer along with the guilty. In 869 Hincmar of Laon laid his entire diocese under an interdict, a proceeding for which he was severely censured by Hincmar of Rheims. In the *Chronicle* of Ademar of Limoges it is stated that Bishop Alduin introduced there "a new plan for punishing the wickedness of his people; he ordered the churches and monasteries to cease from divine worship and the people to abstain from divine praise, and this he called excommunication."

It was not until the eleventh century that the use of the interdict obtained a recognized place among the means of discipline at the disposal of the Roman hierarchy. Important historical instances of the use of the interdict occur, in the cases of Scotland under Pope Alexander III. in 1181, of France under Innocent III. in 1200, and of England under the same pope in 1209. So far as the interdict is "personal," that is to say, ap-

plied to a particular individual, it may be regarded as synonymous with EXCOMMUNICATION (*q.v.*), an ecclesiastical punishment known in one form or another in all churches; the local interdict is quite peculiar to the Church of Rome. It is removed by what is termed "reconciliation."

INTERDICT, in Scotch law, is an order of court pronounced on cause shown for stopping any proceedings complained of as illegal or wrongful. It may be resorted to as a remedy against all encroachments either on property or possession, and is analogous to INJUNCTION, (*q.v.*)

INTERDICTION, in Scotch law, is a process of restraint applied to prodigals and others who, "from weakness, facility, or profusion, are liable to imposition." It is either voluntary or judicial.

INTEREST. At common law an agreement to pay interest is not implied unless in the case of negotiable instruments, when it is supported by mercantile usage. As a general rule therefore debts certain, payable at a specified time, do not carry interest from that time unless there has been an express agreement that they should do so. But when it has been the constant practice of a trade or business to charge interest, or where as between the parties interest has been always charged and paid, a contract to pay interest is implied. Compound interest requires to be supported by positive proof that it was agreed to by the parties; an established practice to account in this manner will be evidence of such an agreement. In short, under the present law, any contract that the parties choose to make as to the amount of interest, or the time or manner of payment, will be enforced like any other agreement.

INTERLAKEN, or INTERLACHEN, a Swiss village in the canton and twenty-six miles southeast of the town of Bern, is situated on the left bank of the Aare in the low-lying district named the Böödeli, between the lakes of Thun and Brienz. The name is strictly applied to the few buildings which occupy the site of the religious houses founded in 1130 and abolished in 1528, but is generally used as including also the Höhweg, a handsome avenue shaded with walnut trees and flanked by hotels and shops, and the village of Aarmühle at its western extremity. The east wing of the Augustinian monastery has been used since 1836 as a hospital for the poor; and the rest of the building, together with the castle added in 1750, is now occupied by government offices. The nunnery, which was suppressed in 1484, has been converted into a prison. The Kursaal, on the Höhweg, was opened by the hotelkeepers in 1869. Between 150,000 and 200,000 strangers visit Interlaken annually, being attracted by its beautiful situation and fine climate, as well as by its goat's-whey cure. Interlaken is a convenient center from which to visit the Bernese Oberland, with the Grindelwald and Lauterbrunnen valleys and the Giessbach and Staubbach falls.

INTERNATIONAL. The International Workingmen's Association, commonly called the "International," was formed at London in 1864. It was a society of workingmen of all nations, somewhat like a cosmopolitan trades union, but bearing a still closer resemblance to an international social science association for discussing and furthering the rights of labor. At first moderate in its tone, it soon began to indorse advanced views respecting property and industrial organization. Shortly after it had attained to the height of its power about 1869, it became more and more allied with the most destructive socialism of western Europe. Weakened by internal disunion, and discredited by its approval of the commune at Paris and its alliance with the communal risings in southern Spain,

the International died a natural death before it was quite ten years old.

The first four congresses of the International, held at Geneva (September, 1866), Lausanne (1867), Brussels (1868), and Basel (1869), marked the rapid development of the association. It gained its first triumph in the effectual support of the bronze-workers at Paris during their lock-out in 1867; and it repeatedly gave real help to the English unionists by preventing the importation of cheap labor from the Continent. In the beginning of 1868 one hundred and twenty-two societies of South Germany assembled at Nuremberg and declared their adhesion to the International. In 1870 Cameron announced himself as the representative of 800,000 American workmen who had adopted its principles. It soon spread as far east as Poland and Hungary, and it had affiliated societies with journals devoted to its cause in every country of western Europe. The leading organs of the European press became more than interested in its movements; the *Times* published four leaders on the Brussels congress. It was supposed to be concerned in all the revolutionary movements and agitations of Europe, gaining a world-historic notoriety as the rallying point of social overthrow and ruin. Its prestige, however, was always based more on the vast possibilities of the cause it represented than on its actual power. Its organization was loose, its financial resources insignificant; its continental unionists joined it more in the hope of borrowing than of contributing support. At the successive congresses its socialistic tendency became more and more pronounced; it declared its opposition to private property not only in railways, but in mines and the soil, holding that these should revert to the community. Even the principle of inheritance was saved only by a narrow majority. In 1869 Bakunin, the Russian socialist or nihilist, with his party joined the association, and at once asserted his character as the "apostle of universal destruction."

In 1870 the International resolved to establish itself at the very heart of the revolutionary movement by holding its annual congress at Paris. This plan was rendered abortive by the Franco-German conflict. That war, however, helped to bring the principles of the association more decidedly before the world. On general grounds, and during the Austro-Prussian struggle of 1866, it had declared its emphatic condemnation of war; and now the societies of France and Germany as well as the general council at London uttered a solemn protest against this renewal of the scourge.

The relation of the association to the communal rising at Paris in the spring of 1871 has been the subject of much dispute. It is now agreed that the International as such had no part either in originating or conducting it; some of its French members joined it, but only on their individual responsibility. Its complicity after the event is equally clear.

INTERNATIONAL COPYRIGHT. For many years the question of international copyright has been agitated through the press of the United States and of England, and in the legislative bodies, both of those and other nations. Finally an act of congress was passed on March 3, 1891, the effect of the workings of which has yet to be seen, under which, after July 1, 1891, it became possible for American authors to secure copyright privileges in certain European countries, the like privileges being granted by the United States to citizens of those countries. The most important items of this law to an American are that international copyright arrangements between the United States and foreign countries now include Great Britain and her possessions, France, Belgium, and Switzerland. For an American citizen to secure copyright in Great Britain

three conditions are necessary: First—the title should be entered at Stationers' Hall, London, the fee for which is 5 shillings sterling, and 5 shillings additional if a certified copy of entry is required. Second—the work must be published in Great Britain or in her dominions simultaneously with its publication in the United States. Third—five copies of the publication are required, one for the British Museum, and four on demand of the Company of Stationers for four other libraries.

Copyright in Canada is to be registered with the Minister of Agriculture at Ottawa, fee \$1 for registry and 50 cents for certificate; and the work to be published in Canada and two copies deposited.

Copyright may be secured in France, by a foreigner, by depositing two copies of the publication at the Ministry of the Interior at Paris. No fee nor entry of title required.

To secure copyright in Belgium a foreigner may register his work at the Department of Agriculture, Industry, and Public Works, at Brussels.

In Switzerland, registry of title at the Department of Commerce and Industry at Berne, is optional, not obligatory, fee two francs. If registered, deposit of one copy is required.

Foreign works to secure copyright in the United States must be printed in America, from type set up and plates manufactured in this country. See, also, **COPYRIGHT**, pages 1765-68.

INTERNATIONAL LAW is the name now generally given to the rules of conduct accepted as binding *inter se* by the nations—or at all events the civilized nations—of the world. International law as a whole is capable of being very differently interpreted according to the point of view from which it is regarded, and its rules vary infinitely in point of certainty and acceptance. According to the ideas of the leading English school of jurists it is an impropriety to speak of these rules as being laws; they are merely moral principles—positive, it is true, in the sense that they are recognized in fact, but destitute of the sanctioning force which is the distinguishing quality of law. On the other hand, the vast majority of writers on international law have preferred to derive its principles from some transcendental source, such as nature, reason, the Divine will, etc.; and these accordingly have no hesitation in attributing to its rules an intrinsic authority over all the nations of the world. Many of the rules of international law are vague, uncertain, and of disputed authority. Some of the rules, for example, relating to capture in war, the law of blockade, and the privileges of ambassadors are so well ascertained and settled that it is hardly conceivable that they should be broken by any civilized state. On other points—*e.g.*, as to what articles should be contraband of war, when a state should interfere with the domestic policy of another—no universally admitted principles can be said to have been established. The substance of international law has been for this reason divided into various sections, according to the degree of certainty which the rules have obtained. Thus one of the most recent writers on this subject, Doctor Woolsey, distinguishes the rights and duties known to the science as (1) those which are deducible from natural *jus*, which no action of a state can begin or terminate, (2) those deducible from the idea of a state, and (3) those which can be created or destroyed by compact, express or tacit. This and similar divisions do not really explain why some of the rules composing what is known as international law are as fixed and certain as rules of conduct can well be, while others are pure matter of controversy. It is simpler to state the fact and to take note that the area of certainty in international law is constantly increasing.

For example, the rights of embassies were disputed by England till a recent period; and the rules prohibiting the slave-trade and making privateering illegal are comparatively recent additions to the certainties of international law. To say that such rules as the last, being founded on contract, are therefore of inferior authority to the imperishable principles which pronounce all sovereigns to be equal and independent, and distinguish between just and unjust wars, is absurd.

The theory of international law contemplates the world as divided into independent states. That states are sovereign within their own territories, independent of other states, and equal as between themselves is a fundamental axiom of the science. Not that all states are regarded as lying within the domain of this law. In modern times at least it has included all the states of the Christian world; but at one time it excluded non-Christian states, and at this moment it would be difficult to say to what extent it covers the relations of such states *inter se* and with the Christian states of Europe and America. There is little doubt, however, that in course of time all the civilized communities of the world will observe substantially the same system of international law.

In the next place international law regards the states of the world as being either in a state of war or in a state of peace. It prescribes rules of conduct to be observed in the mutual dealings of nations which are at peace with each other, and of nations that are at war with each other; and it fixes the rights and duties of belligerent and neutral nations. If peace is the normal state of nations, as jurists sometimes assert, war is the state which has made the largest demands on the science. The rules of international law with regard to war are more voluminous and more certain than those which govern nations in time of peace.

International law, as we now know it, is substantially the creation of civilized Europe in the last three hundred years, but rules of some kind, however meager, must accompany any state of society in which intercourse, hostile or peaceful, between different communities is common. The great nations of antiquity which have contributed most to the civilization of modern Europe have given least to this branch of that civilization. The *jus gentium* of the Romans does indeed play an important part in the history of international law, but as conceived of by the Roman lawyers it was not international, but a body of positive law composed of the elements common to the nations known to them, including Rome itself. Positive international law does not in fact come into existence until the era of Grotius, although usages of international intercourse must at all times have existed. The sanctity attributed to ambassadors, the importance of formal declarations of war, and the good faith to be observed in promises or treaties would probably be found to be the points of most general recognition.

Independent sovereign states are the units of international law, and whether a given community is such a state is a question of fact. A community having definite territorial limits within which its own government exercises absolute authority, free from all external control, is the proper type of a state in international law. But the world is not parceled out among states thus accurately defined. Where a number of states have been united in a permanent confederation, it may be a question whether the group alone is in international law an independent state, or whether each individual member has retained its international independence. The United States of America are an example of the former case; the German confederation until the recent changes was an example of the other. Again, when

one state has placed itself under the protection of another, it may be a question whether it has lost or retained its independent status in international law. The proper test, according to Phillimore, is its capacity *de facto* to deal with other states in peace or war, without reference to the protecting state. States which have lost this capacity have been called semi-sovereign states. They have the organization of an independent nation, but are in practice subject to the rule of another state. The Ionian Islands under the English protectorate were in that position, and in the treaty of 1815 they are described as a single, free and independent state, under the exclusive protection of Great Britain. A similar character attaches to some of the dependencies of Turkey. On the other hand, a large portion of the surface of the earth is occupied by communities having neither the permanent territorial occupation nor the social coherence of civilized states, yet entering into such relations with them as require the recognition of some system of rules. A further question of the highest importance may arise when a portion of an existing state rises in rebellion and sets up a claim to independence. Here again the question is one of fact. If the rebels have succeeded in establishing a government, it is the right and duty of the nations to recognize the fact, and each nation must judge for itself whether the time for recognition has come. Premature recognition would be regarded as an aid to rebellion inconsistent with the rules of international law. The criterion suggested by practice and authority is whether the old government had ceased to contend in fact against the revolutionary state. But other nations are not bound to wait until the old government has itself recognized the independence of the new. Similar questions arise when the form of government in any country is changed by revolution, or when portions of one state are transferred by conquest to the dominion of another. When the new state of things is established in fact, no matter whether justly or unjustly, it must be recognized by other nations.

With the question of recognition is intimately connected that of non-interference. Premature recognition of a struggling rebellion would be regarded as a breach of the principle of non-intervention, but to recognize the independence of an independent State is part of the same duty as to abstain from interfering with it when it has been established.

Independent states are said to be equal in international law, because it is contrary to the nature of an independent state to be in servitude to another. The proposition negatives any claim of precedence on the part of one or more states in international rank, and asserts that all states equally are entitled to the benefit of international rules. No difference in constitution affects this equality, a republic being the equal of a kingdom, and a kingdom of an empire. Beyond this it can hardly be stretched. It is consistent with conventional inequalities in the reciprocal treatment of nations, and with the habitual recognition in Europe at least of the predominance of the Great Powers.

States in relation to the territories occupied by them are treated on the footing of proprietors in law. As between nations each is the absolute owner of its dominions, and the principles applicable to their ownership are taken, as already said, from the Roman law of things.

The territory of a state includes all the lands and inland waters within its boundaries, the mouths of rivers, bays, and estuaries, and the sea to the distance of a marine league along the coast. By a fiction vessels on the high seas, and public vessels everywhere, are treated as part of the territory of the state to which they be-

long. The high seas are no nation's property—although in the earlier stages of international law exclusive pretensions have been set up to particular seas, as by Spain to the Pacific, England to the seas around Great Britain, and Russia to the North Pacific.

Formal intercourse between nations is carried on under well-ascertained rules. Omitting mere ceremonial regulations, we may notice specially the position assigned by the law of nations to ambassadors. These are the highest class of diplomatic agents, and according to the universal modern practice they are permanently attached to the foreign court to which they are accredited. The office of ambassador, whether permanent or temporary, has at all times been clothed with a character of peculiar sanctity. His privileges during residence at a foreign court may be summed up in the statement that himself, his house, his property, and his household are exempt from the foreign jurisdiction. Like a ship of war in foreign waters, the embassy is exterritorial—supposed by fiction of law to be part of the sovereign's dominions. The ambassador, therefore, is not liable to prosecution in the criminal nor to suit in the civil courts. His official residence is free from the local jurisdiction; but it is no longer an asylum, and a criminal taking refuge there may be seized by the local authority if not delivered up by the ambassador. Ambassadors are further relieved from taxation on goods imported for their own use, a privilege which has not infrequently been abused. An ambassador is entitled to freedom of worship, whether his religion be tolerated by the local government or not. The suite of an ambassador down to his domestic servants are also exempt from the local jurisdiction. The household may in some respects be likened to a separate community under the sovereignty of the ambassador. But it is only in minor affairs that his power to actually execute criminal justice on his own servants would now be recognized. The proper course for him to adopt in a serious charge would be to send the accused home to be tried. The privileges of an ambassador and his suite, it should be added, apply only so far as they do not act beyond the limits of their legatorial character—*e.g.*, as merchants, trustees, and so on. Exceptional crimes committed by an ambassador do not destroy his character or rights—at least according to the general consensus of modern authorities, although English lawyers have argued that a crime *contra jus gentium* destroyed the ambassadorial character. Besides ambassadors, two inferior grades of foreign ministers are recognized, *viz.*, (1) envoys, ministers, or others accredited to sovereigns, and (2) *chargés d'affaires* accredited to ministers charged with foreign affairs. These three grades of diplomatic rank were settled by the congress of Vienna (1815) to avoid the embarrassment arising from claims of precedence. Consuls are merely local agents of a foreign government, for certain limited purposes, such as facilitating and recording legal transactions affecting the subjects of the state they represent, and assisting them in obtaining their legal rights. They are appointed with the permission (*exequatur*) of the country in which they are to act. They have no immunity from local jurisdiction except under special arrangements. In non-Christian countries the consuls representing Christian states have more extensive functions. In Turkey and the Mahometan countries of the Levant they exercise generally an exclusive criminal and civil jurisdiction over their countrymen.

Hitherto we have considered nations as in a state of peace. War introduces an entirely new order of rules, applying either between the belligerents themselves or between belligerents and neutral states. To the question whether a given war be just or unjust international

law has no answer to give, or only a formal one. Any war undertaken in defense of the rights which have been already described might be called a just, and any war undertaken in violation of them might be called an unjust, war. The justice or injustice of any war is really a question of morality, and in proportion as international law has escaped from the merely ethical region it has abandoned the attempt to decide this question. But all wars are legal in international law—that is, they are governed by the rules of the law of war—except wars levied by pirates or piratical communities. The part played by international law has been not to prevent but to regulate warfare. Nations have arrived at a tolerable degree of unanimity as to how wars ought to be conducted, and the result is a certain and progressive law of war. They are far from having arrived at any understanding as to the conditions under which war ought to be allowed; when they are within sight of any such understanding, it will be time enough to talk about a war being just or unjust in international law.

The absence of any legal standard of the justice of a war only adds to the importance of the moral question. There being no law of nations to restrain the warlike ambition of nations, as there is to restrain the passions when war has begun, the purely moral restraints become all important. Among these it might not be worth while to reckon the kind of selfishness which counts the cost of a campaign against a powerful enemy. But a generous horror of war for its own sake may safely be pronounced to be, in spite of recent events, a growing public sentiment, particularly in the English-speaking people of both worlds. There is no English or American statesman who would not at least do lip-service to the principle that an avoidable war is a public crime. Some of them have done more. The great experiment in international arbitration between England and America in 1871 was more glorious to its promoters, and will be more fruitful of benefit to mankind, than fifty victorious campaigns. It is through the establishment of the principle of arbitration that we may ultimately hope to see the question of justice or injustice in war take its place among the topics of international law.

INTER-OCEANIC CANALS. Since the successful construction by M. Ferdinand de Lesseps of the through water communication between the Mediterranean and the Red Seas (see CANAL) the problem of inter-oceanic canals has become one of the most interesting of the age. Particular interest attaches in the United States to the different propositions for ship-canal communication between the Atlantic and Pacific oceans across the Isthmus. In this country the plans most favored have been those which contemplated the Tehuantepec route, that known as the Atrato-Napipi, and the Nicaragua scheme. As early as 1872 the first named route was surveyed by Captain Shufeldt, of the U. S. navy, but its insufficient water-supply, height of summit level, and great number of locks required practically put it out of consideration. In 1873 Professor Mitchell, of the U. S. coast survey, made examinations of the proposed routes, and these were supplemented in 1874 by Lieut. Frederick Collins, U. S. navy, who re-surveyed the Atrato-Napipi route, and by Com. E. P. Lull, U. S. navy, who investigated the Aspinwall and Bay of Panama route. Lieutenant Collins found that a canal of thirty and one-fourth miles from the river Atrato to Chiri-Chiri on the Pacific would be required; three and a half miles being in tunnel. A cut averaging ninety feet would be needed for five miles east of the tunnel; the summit level would be one hundred and forty-three feet above mean tide and twenty-two locks would be necessary. In round numbers the cost of this plan was estimated at \$100,000,000.

Commodore Lull gave up the idea of a sea-level canal and surveyed for a lock canal from Aspinwall to Panama. This followed the line of the Chagres Valley to its junction with that of the Obispo, and thence along the line of the latter to the divide, 294 feet above sea-level, descending to the Bay of Panama through the valley of the Rio Grande. This plan proposed the crossing of the Chagres river by a viaduct 1,900 feet long, the surface of the water in the viaduct being the summit-level of the canal, 123¾ feet above tidewater. The length of this proposed canal from sea to sea would be almost forty-two miles, and it would require twenty-four locks and a tidal-lock on the Pacific side. It was proposed to use the Chagres river as a source of supply. The cost of this plan was estimated at about \$95,000,000.

On February 7, 1876, the Inter-Oceanic Commission, after considering the plans submitted to it, reported to the president of the United States in favor of the original Nicaraguan route extending from the harbor of Greytown on the Caribbean Sea to Port Brito, on the Pacific. They considered that the route as located by the United States surveying expeditions of 1872-73 "possessed both for construction and maintenance of a canal greater advantages, and offers fewer difficulties from engineering, commercial, and economic points of view, than any one of the other routes shown to be practicable by surveys sufficiently in detail to enable a judgment to be formed of their relative merits." The cost of this canal was estimated at \$100,000,000.

Fresh from his triumph at Suez, the great French engineer, De Lesseps, turned his attention to the problem of piercing the Panama isthmus. In 1876 and the following year, French surveying parties looked over the ground and mapped out several routes. In 1879 the Geographical Society of Paris called an international conference which met at Paris in May, and after fourteen days' deliberation pronounced in favor of a sea-level canal from the Gulf of Lunon to the Bay of Panama. The route adopted was that recommended by Lieutenants Wyse and Reclus, of the French navy. The cost was estimated at 1,044,000,000 francs or about \$209,000,000, and it was proposed to make a new channel to the sea to carry off the surplus waters of the Chagres, which is subject to sudden floods. An appeal to the public for subscriptions to the "Société Internationale du Canal Interoceanique" failed. The public believed the cost would greatly exceed the estimate, and M. de Lesseps accordingly made another survey, with the assistance of a commission of engineers. They reported that the amount of excavation necessary had been underestimated by at least 40 per cent., and their estimate of the cost of the Chagres drainage stream was four times that of the congress. In all they thought the canal would cost 843,700,000 francs, and this estimate was reduced by M. de Lesseps to 658,000,000 francs, or about \$132,000,000.

In July, 1880, a subscription was opened by the "Universal Company" for 300,000,000 francs. The public responded nobly, all France was in a furore over the great scheme, and the shares offered were subscribed for twice over. The Panama Canal Company was at once organized and preparations made for beginning the work; M. de Lesseps promising its completion in 1888. The route, practically that suggested by Wyse, extended forty-five and one-half miles from sea to sea. The canal was to be one hundred and sixty-four feet wide at the water-line, seventy-two feet wide at the bottom, with a uniform depth of twenty-eight feet below mean low tide. In the heavy cuttings the depth was to be 29.4 feet, the width at the water-line eighty-five and one-half feet and at the bottom seventy-nine feet. The "deep cut" was to be fifteen and one-half miles in length and its maximum

depth at the divide 333 feet. The work of final surveys, the preparation of quarters for laborers, and the getting machinery and plant in place was begun in 1881, and actual excavation commenced in the spring of 1882. An enormous number of men were set to work on different parts of the line, and rose-colored reports of progress were made from time to time.

But disease broke out and a fearful mortality among the working staff followed. The Chagres river proved to be absolutely unmanageable and disaster marked the path of the great enterprise. By May, 1885, more than \$100,000,000 in cash had been expended, the obligations contracted exceeded that amount by one-half, and not 10 per cent. of the total excavation estimated as necessary had been made. M. de Lesseps visited and revisited the Isthmus, and each time expressed his renewed confidence in his ultimate triumph, although conceding finally that an extension of time would be required, and more money needed. But the reports of independent experts, sent out by English capitalists, made a very different showing to those of the optimistic engineer. Renewed subscriptions were sought, but the response was not favorable, and, finally, after an attempt to secure an enormous subvention from the French Government had failed, the failure of the project was announced, and the work practically abandoned. The actual truth as to the situation is scarcely known even yet, but it is certain enough that this century will not see the completion of De Lesseps' canal.

An alternative route, which finds much favor in the United States, has been suggested and is known as the Nicaraguan route. The proposed canal extends from Greytown or San Juan del Norte, on the Caribbean Sea, to the port of Breto, on the Pacific. Its length is 169.8 miles, of which 40.3 miles are canal, and 129.5 miles open navigation through Lake Nicaragua, the San Juan river, and the basin of the San Francisco river, a tributary of the San Juan. To carry out this plan seven locks will be necessary, the rivers will have to be deepened and widened and some very heavy rock cutting done. The scheme contemplates a canal from 80 to 120 feet wide at the bottom and from 80 to 340 feet wide at the surface, with ample depth for all ocean-going vessels. Its estimated cost is \$65,000,000.

INTERPLEADER, in English law, is the form of action used when a person is sued at law for the recovery of money or goods wherein he has no interest, and which are also claimed of him by some third party.

INTESTACY. In dealing with the property of a person who dies without making a will, the law of England distinguishes sharply between his real and his personal estate. The devolution of the former is regulated by the rules of INHERITANCE, (*q.v.*) The destination of the latter is marked out by the Statute of Distributions. The proper conditions of a testamentary disposition of property will be found under the heading WILL.

The distribution of an intestate's personal estate is carried out under the authority of administrators, whose duties are generally the same as those of executors under a will.

In the United States the English Statute of Distribution has been taken as the basis of the law for the distribution of personal property in intestacy, and its principles have been applied to real property also. In a majority of the States the descent of real and personal property is to the same persons and in the same proportions, and the regulation is the same in substance as the English Statute of Distribution. In Georgia the real and personal estate of the intestate is considered as altogether of the same nature and upon the same footing.

INUNDATIONS. From time to time history has

recorded the occurrence of great disasters arising from the overflow of land by the waters of streams and seas. With few exceptions the traditional records of the oldest civilizations contain references to a general flood, and more authentic history chronicles these catastrophes by the hundred. The United States has been a great sufferer by inundations, particularly in the valley of the Mississippi. The most disastrous flood of modern times occurred on May 31, 1889, when by the breaking of a dam in the Conemaugh valley, Penn., the whole of the valley was flooded, and a greater part of the city of Johnstown was swept away. An official statement of the loss of life on this occasion is: bodies found and identified, 1,072; bodies buried as unknown, 648; missing, 575—total known loss, 2,295. Other estimates place the loss at nearly double this figure and the damage to property was several millions.

INVERARY, a royal, parliamentary, and municipal burgh of Scotland, the county town of Argyllshire, forty miles southwest of Glasgow. Population, 1,000.

INVERNESS, a maritime county of Scotland, is bounded on the north by Ross, northeast by Nairn and Elgin, east by Banff and Aberdeen, southeast by Perthshire, south by Argyll, and west by the Atlantic. It measures eighty-five miles from northeast to southwest, and fifty-five miles from northeast to southwest. The total area is 2,723,840 acres or 4,256 square miles. The mainland portion has an area of 3,043 square miles, of which 135 are under water. The area of the islands is 1,213 square miles, of which the area under water is sixty-one square miles. The surface of the county is very varied, consisting of ranges of lofty mountains alternating with deep narrow valleys, the beds of numerous lakes and rivers. Its exterior outline is very irregular. Both the mainland and island portions abound in grand and picturesque scenery. The islands in the county are those of the Outer Hebrides (excluding Lewis, which belongs to Ross-shire, but including Harris), and Skye, Raasay, Rona, Scalpa, Eigg, etc. (See *HEBRIDES*.) The mainland portion is divided into two nearly equal parts by the valley of Glenmore, or the Great Glen, which crosses it from the southwest to the northeast. This glen is now traversed by the Caledonian Canal, which, begun in 1803 and finally completed in 1847, forms a line of inland navigation between the east and west seas, from the Moray Firth on the northeast to Loch Linnhe on the southwest. The greater part of the county is occupied by mountains, many of which are over 3,000 feet in height, the highest summits being Ben Nevis, 4,406 feet, and Cairngorm which is partly in Banffshire, 4,095 feet. Within the last twenty-five years great progress has been made in the reclamation of waste land, the arable land in 1855 extending only to 42,030 acres. There are nearly 300,000 acres of deer forests, and about 1,700,000 of heath land, one-half of which affords pasturage for sheep, the other half being of no value except for grouse shooting. The population is about 90,000.

INVERNESS, a royal, parliamentary, and municipal burgh of Scotland, the capital of the above county, is finely situated at the northern end of Glenmore, on both sides of the river Ness, about half a mile from its mouth, and on the Highland Railway, 144 miles north-northwest of Perth, and 109 west-northwest from Aberdeen. Population, 17,365.

INVESTITURE, in feudal phraseology, means the act of giving corporeal possession of a manor or office—an act which was usually conjoined with some significant ceremonial, such as the delivery of a branch, a banner, or some other appropriate symbol of the thing conveyed. Investiture with staff and ring was during

and after the eleventh century the name given to the ceremony by which ecclesiastical dignitaries were admitted by the civil power to possession of the temporalities of their office. The word investiture is later than the ninth century; the thing itself is an outcome of the feudal system.

IO is the heroine of a legend associated with the cultus of Hera, both in Argos and in Eubœa. In Argos the great temple of Hera was situated on a hill called Eubœa, on the road from Mycenæ to the city of Argos; while in Eubœa the legend was associated with the town of Argoura. The identity of names shows that the legend dates from a very ancient period of the worship; and as, in accordance with the universal rule in such legends, Io is only a form of the goddess, it is highly probable that she represents an older stage of the cultus than the better known Hera.

IODINE, thus named on account of the violet color of its vapor, is one of the so-called halogen elements.

Iodides occur in minute quantity in most mineral waters and in sea water. The ashes of many marine algæ are rich in them; and formerly iodine was chiefly extracted from kelp or varec, the ashes of seaweed, by distilling the mother liquor remaining after the separation of the less soluble salts by crystallization with manganese dioxide and sulphuric acid. Of late years, however, large quantities of iodine have been obtained from crude Chili saltpeter by a similar process.

The chief use of iodine is in the preparation of methyl-iodide, a substance employed in the manufacture of certain of the so-called aniline dyes. In medicine it is frequently applied externally as an irritant. Potassium iodide is also an important medicinal agent; and iodoform, a substance prepared by acting on alcohol with iodine in presence of an alkali, has latterly been introduced as an agent for external application in certain diseases. It is one of the most approved antiseptics and is extensively used in dressing wounds of any nature whatever. Several iodides, especially ammonium, cadmium, and potassium iodide, are largely employed in photography.

ION, of Chios, one of the five Greek tragic poets of the canon, was born in Chios, probably in the 74th Olympiad—485–480 B.C. Although he seems to have lived much in his native island, where he met Sophocles in 441 B.C., he paid frequent visits to Athens, making the acquaintance of Æschylus, and becoming a warm admirer of Cimon and a severe critic of the rival statesman, Pericles. His first tragedy dates from the 82d Ol., between 452 and 449 B.C.; and he is mentioned as third to Euripides and Iophon in the tragic contest of 429 B.C. From a passage in the *Peace* of Aristophanes which was produced in 421 B.C., it is generally concluded that Ion died before that year. The names and a few fragments of eleven of Ion's plays remain; the latter give him a place only inferior to the three great tragic masters of Greece.

IONA, or ICOLMKILL, a small island of the Hebrides, on the west coast of Scotland, in the county of Argyll, is situated about eight miles south of Staffa and one and one-quarter miles west of the southwestern promontory of Mull, from which it is separated by the shallow Sound of Iona. Its length is about three and one-half and its breadth one and one-half miles. The total area is about 2,000 imperial acres, of which about 600 are under cultivation.

IONIA, capital of a county of the same name in Michigan, is situated on Grand river, at the junction of several railroads. It is thirty-four miles east of Grand Rapids and thirty-eight miles northwest of Lansing, the State capital. It contains two national and one other bank, a high school and several public schools,

ten churches, foundries, potteries, breweries, flour-mills and railroad machine-shops. The town, which has a population (1890) of 5,000, is noted for its fine residences.

IONIA, in ancient geography, was the name given to a portion of the west coast of Asia Minor, adjoining the Ægean Sea, and bounded by Lydia toward the east. Like the adjoining districts of Æolis on the north and Doris on the south, it was not a country or region marked out by any natural boundaries, but merely consisted of a strip of land near the coast, of comparatively small breadth, which, together with the adjacent islands, was occupied by Greeks of the Ionic race, and was thus permanently distinguished from the interior district, which was inhabited by the Lydians.

According to the tradition universally received among the Greeks, the cities of Ionia were founded by emigrants from Greece on the other side of the Ægean, and their settlement was connected with the legendary history of the Ionic race in Attica and other parts of European Greece, by the statement that the colonists were led by Neleus and Androclus, the two sons of Codrus, the last king of Athens. All that we know upon anything like historical evidence is that at the earliest period when we hear of any Greek population as existing on the east coasts of the Ægean we find there a large group of cities, distinct in dialect and institutions from those of the north and south of them, and generally regarded both by themselves and their neighbors as derived by direct immigration from the people who bore the name of Ionians in European Greece. Of the period of their settlement in Asia we have no trustworthy evidence; but it appears to have been anterior to the rise of the Lydian monarchy, which gradually became their most formidable neighbor.

The cities comprised under this name in historical times were twelve in number—an arrangement copied, as it was supposed, from the constitution of the Ionian cities in Greece, which had originally occupied the territory in the north of the Peloponnesus subsequently held by the Achæians. These were (proceeding from south to north)—Miletus, Myus, Priene, Ephesus, Colophon, Lebedus, Teos, Erythræ, Clazomenæ, and Phocæa, together with the two important islands of Samos and Chios. Smyrna, which subsequently assumed so prominent a position among the cities of this part of Asia, was originally an Æolic colony, but was afterward occupied by a band of Ionians from Colophon, and became thenceforth an Ionian city—an event which had taken place before the time of Herodotus. But at what period it was admitted as a member of the Ionian League we have no information.

The cities above enumerated unquestionably formed a kind of league or confederacy among themselves, of which their participation in the Pan-Ionic festival was the distinguishing characteristic. But, like the Amphyctyonic League in Greece itself, this was rather of a sacred than a political character; every city, as usual among the Greeks, enjoyed absolute autonomy, and, though common interests often united them for a common political object, they never formed a real confederacy like that of the Achæians or Bœotians; and the advice of Thales of Miletus to combine in a more intimate political union found no approval among them.

The territory thus occupied was of small extent, not exceeding ninety geographical miles in direct length from north to south, with a breadth varying from twenty to thirty miles, but to this must be added the remarkable peninsular promontory of Mimas, together with the two large islands. So intricate indeed is the coast-line that the *periplus* or voyage along its shores was estimated at 340 geographical miles, or nearly four times the direct

distance. A great part of this area was, moreover, occupied by mountains, none of them attaining to any great elevation, but filling up a considerable space.

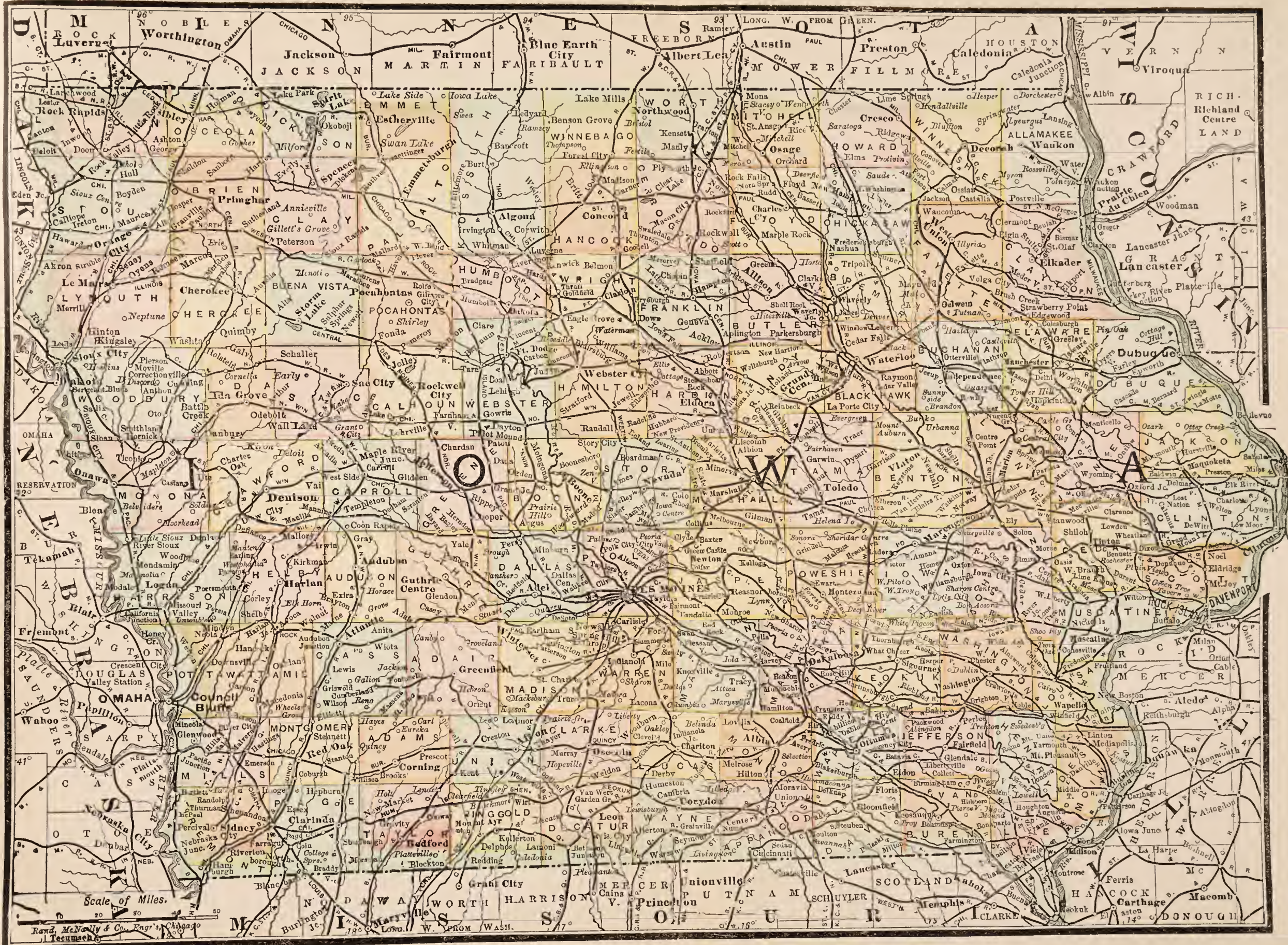
IONIAN ISLANDS, the ordinary collective name of Corfu, Cephalonia, Zante, Santa Maura, Ithaca, Cerigo and Paxo, with their minor dependencies. As the islands are seven in number they are often called the Heptanesus in Greek, and Heptanesian or Septinsular is the corresponding adjective. The history of the use of Ionian as the distinctive epithet of the islands is sufficiently obscure; but it is probable that, like the application of the name Ionian Sea to this part of the Mediterranean, it is due to the settling of Ionian colonists on the coasts and islands. The islands have no real geographical unity beyond that involved in the fact that, with the exception of Cerigo, situated off the south coast, they are all within a little distance of the west coast of Greece or Albania. Corfu is separated from the mainland by not more than two miles, while the passage from it to Santa Maura, the nearest of the larger islands, is no less than forty-six. Since 1863 the whole Heptanesian territory has been incorporated with the kingdom of Greece, and the several islands have been assigned to different administrative divisions. Corfu, Cephalonia and Zante each gives its name to one of the thirteen nomarchies of the kingdom; Cerigo is part of the nomarchy of Argolis and Corinth. The area of the seven islands is computed at 1,041 square miles. The population shows a steady increase: in 1836 it was 204,242 (110,496 males, 93,746 females); in 1854, 228,981 (123,254 males, 105,727 females); in 1870, 229,516; and in 1890, 301,000.

IOWA, one of the northwestern States of the American Union. Its boundary lines are—on the south and north the parallels $40^{\circ} 36'$ and $43^{\circ} 30'$ of N. latitude, on the east the Mississippi river, and on the west the Missouri and Big Sioux rivers. The southeastern corner projects slightly below the parallel of $40^{\circ} 36'$, the boundary following the Des Moines river down to its mouth. The neighboring States are Minnesota on the north, Wisconsin and Illinois on the east, Missouri on the south, and Nebraska and South Dakota on the west. The length of the State from north to south is about 200 miles, and its greatest breadth from east to west 300 miles. Its area is 35,855,900 acres, or 56,025 square miles.

The State lies entirely within the prairie region of the Mississippi valley, and has a level or undulating surface. Its mean height above the sea is 925 feet—ranging from 500 in the southeast to 1,700 in the northwest. About 24,600 square miles of the area rise less than 1,000 feet above sea-level.

The surface presents very little relief. A broad elevation (1,700 feet at the north boundary, and decreasing gradually southward) separates the waters of the Mississippi from those of the Missouri. The position of this "divide" is, for the most part, near the western border of the State, giving to the branches of the Mississippi long courses and an easy fall, while those of the Missouri have comparatively short courses and a rapid fall. Near their sources, these branches, both of the Mississippi and Missouri, flow in broad, shallow valleys. Farther down their courses, however, bluffs develop, and increase gradually in height, while the valleys in general become narrower. The bluffs bordering the valley of the Mississippi range in height from 200 to 400 feet, the valley between them being usually from four to eight miles in width, although in a few places, as at Dubuque, they close in upon the river on both sides. On the Missouri, the bluffs range from 200 to 300 feet in height, inclosing a bottom-land five to twelve miles in width.

The Mississippi and Missouri are the only navigable



rivers. They have ample depth of water for all purposes of inland navigation. The other rivers are the Upper Iowa, Turkey, Maquoqueta, Wapsipinicon, Iowa, Cedar, Skunk or Checauqua, and Des Moines, flowing into the Mississippi, and the Chariton, Nodaway, Grand, Nishnabotany, and Little and Big Sioux, flowing into the Missouri. None of these streams are navigable. A few small lakes are found in the northwest, on or near the divide between the two great rivers. The area of swamp and marsh surface is proportionately small, and is rapidly diminishing.

As in most of the prairie region of the Mississippi valley, there is in this State but little forest, the timber being confined to the bottom-lands of the streams and the faces of the bluffs. The commonest trees are the oak, elm, cottonwood, black walnut, hickory, maple, and linden. Upon the bluffs is found a sparse growth of pines and red cedar.

It is estimated that about 7,000 square miles are underlaid by the Coal-measures. Within this area coal beds of workable thickness and quality have been found at Fort Dodge, Moingona, Des Moines, and Oskaloosa, where they are being extensively worked. The coal is bituminous, no anthracite having been found in the State. The northeastern part of Iowa is included within the great lead region of the Upper Mississippi; and, although the palmy days of the mines of that region are over, the product is yet very important. The ore, which is galena, is found in pockety deposits in the limestones of the Silurian formation. These deposits vary immensely in size, and in general extend to no great depth, and therefore cannot be relied upon for permanence.

The climate resembles in its essential features that of the rest of the prairie States, excepting that toward the west the aridity of the atmosphere and the decreased rainfall characteristic of the great plains begin to be perceptible. The annual rainfall ranges from twenty-four to forty-four inches, with an average of about thirty-six inches, the southeastern portion receiving the greatest amount, and the western part the least. The mean annual temperature ranges from 42° to 52° Fahr., the summer mean from 66° to 79° and the winter mean from 14° to 27°, showing a difference between the summer and winter temperatures of 52°.

The agricultural interest is by far the largest and most important in the State, as the figures for 1890 will show:

PRODUCTS.	Acreage.	Total bushels.	Value.
Corn	7,953,000	326,073,000	\$ 58,693,140
Wheat.....	2,028,000	27,378,000	16,426,800
Oats.....	2,713,000	113,916,000	17,091,900
Rye.....	107,090	1,837,620	606,414
Barley.....	155,797	4,362,316	1,134,202
Buckwheat.....	21,000	336,000	201,600
Flax.....	246,715	2,528,830	2,604,694
Irish Potatoes....	172,200	21,008,400	3,623,949
Sweet Potatoes....	2,200	176,000	186,560
Sorghum, gallons...	21,553	2,263,065	984,433
Broom Corn, tons...	2,320	7,730	587,480
Tame Hay, tons....	3,334,225	5,668,182	24,033,091
Hay, prairie and other (estimated) }			6,500,000
Timothy Seed.....		800,000	932,000
Clover Seed.....		140,000	467,600
Millet Seed.....		330,000	168,300
Total.....			\$134,242,165

The soil is extremely fertile, whether drift, bluff, or alluvial. The drift, whose name explains its origin,

covers the greater part of the State. It is a dark loam, one to two feet in depth, and of almost inexhaustible fertility. The bluff soil or loess occupies the country bordering upon the valley of the Missouri. It is supposed to be a subaërial deposit, brought by the prevalent westerly winds from the plains of Nebraska and Dakota, and deposited here near the borders of the humid region. It has a great depth, reaching 200 feet in some instances, and is everywhere extremely rich.

The manufacturing industries have not yet reached a high degree of development. Those branches connected with agriculture have naturally made most advance. For means of communication and transportation Iowa is dependent almost entirely upon its railroads and its two bounding rivers. It has no canals, if we except the short one around the Des Moines rapids.

In 1890 the railroads had 8,260 miles of track, the assessed valuation of railroad property being \$42,858,890. The gross earnings of all the railroads for 1888 were \$37,462,779.

The number and value of different classes of live stock on January 1, 1890, were:

	No.	Value.
Horses.....	1,095,300	\$72,628,310
Mules.....	42,316	3,341,271
Milch cows.....	1,331,888	26,358,064
Oxen and other cattle.....	2,577,161	46,466,312
Swine.....	5,805,000	34,481,700
Sheep.....	475,816	1,332,254

The officers of the executive department are the governor, lieutenant-governor, secretary of state, auditor, treasurer, superintendent of public instruction, who, except the second named, form the executive council. All these officers are elected by the people, the term of office being in each case two years. No one is eligible for the office of governor or lieutenant-governor who is less than thirty years of age, or has not been a citizen of the United States and of the State for at least two years. The governor is commander-in chief of the militia, and possesses the pardoning power except in cases of treason. The lieutenant-governor is *ex officio* president of the State senate; and, in the event of the death, resignation, or removal of the governor, he assumes his office.

The legislative department is vested in the general assembly, which consists of a senate and a house of representatives. The former consists of not more than fifty senators, who are elected for terms of four years. Each senator must be at least twenty-five years of age, and must be a citizen of the State. The house of representatives consists of not more than 100 representatives. Their term of office is two years. A representative must have attained the age of twenty-one years. The general assembly meets at Des Moines (which since 1857 has been the capital), and holds a regular session once in two years.

The judicial department comprises a supreme court and district and circuit courts. Its officers are the judges of the several courts, clerk and reporter of the supreme court, attorney-general and district attorneys, all of whom are elected by the people. The supreme court consists of four judges, whose term of office is six years. The senior in office is the chief justice. The State is divided into a certain number of judicial districts, in each of which are elected every four years a judge of the district and of the circuit court and a district attorney. The latter is the prosecuting attorney for his district.

The representation of the State in the national congress consists of two senators, chosen by joint ballot of the two houses of the general assembly, and of eleven representatives, elected directly by the people of the congressional district.

The State is divided into ninety-nine counties. Their officers are all elected by the people, and the tenure of office is two years. They are—three, five, or seven supervisors (who collectively form a "board of supervisors"), an auditor, a clerk of the district and circuit courts, a sheriff, treasurer, recorder, superintendent of schools, coroner, and surveyor. The board of supervisors have authority over the property of the county, levy State and county taxes, and keep in repair roads and bridges. Each county is divided into civil townships, which are six miles square, corresponding with the congressional townships of the general land system. Each township is under a civil government, administered by three trustees, a clerk, an assessor of taxes, and two or more justices of the peace and constables. All these officers are elected by the people, for one year, except the justices of the peace, whose term is two years.

The assessed valuation of property (real and personal) was in 1890 nearly \$2,500,000,000. The debt of the State was only \$245,435 and that due to the school fund. The total bonded and floating debt of the counties was \$2,932,376; of the cities, \$3,257,200; and of the school districts, \$1,125,138. Iowa has 125 national banks and a large number of private banks. Its educational system is similar to that of all the states which were formed from the Northwest Territory; every sixteenth section of land being set apart for the permanent school fund. The amount of the permanent fund was \$3,732,174 and of the available funds \$3,681,432. The school population numbered in 1890 660,495. The number of pupils in the public schools was 493,267. School statistics for 1890 show 12,094 ungraded schools, with an average duration of nearly eight months in the year, and 84,957 volumes in their libraries. The male teachers numbered 5,460, the females 21,107. The 12,997 school-houses were valued at \$12,715,766. The county school-house fund was \$334,699; the contingent fund \$619,233, and the teachers' fund \$2,149,302.

The State has a large number of institutions for higher instruction, and is well supplied with reform schools, orphan asylums, and asylums for the blind and the deafmute class. No State in the Union has a larger church representation. In 1882 the state adopted by 155,436 votes against 125,677 a constitutional amendment prohibiting the manufacture and sale of liquors, wine, and beer, but the Supreme Court decided that it had not been constitutionally adopted. In 1885 the legislature passed a prohibitive statute which is still in force.

The population of Iowa has increased steadily and swiftly since its settlement. In 1840 it contained 43,112 people; in 1870, 1,194,020; and in 1880, 1,624,620. Official returns of the United States census of 1890 show a population of 1,911,896, a gain of 17 per cent. during the decade. There are no towns of over 60,000 population in the State, but the number of thriving towns of from 5,000 to 40,000 population is large.

Iowa was originally a part of the Louisiana purchase. In 1834 all that part of the United States lying west of the Mississippi river and north of Missouri, including the present area of Iowa, was placed under the jurisdiction of the Territory of Michigan, and two years later the Territory of Wisconsin was created, including what is now Iowa. In 1838 Iowa itself was made a Territory, and on December 28, 1846, it was admitted to the Union as a State. At the time of the Louisiana purchase, this region was occupied by the Sioux, Sac and Fox, and Iowa tribes of Indians. The first white settlements within the State were made along the Mississippi in 1833—Fort Madison, Burlington, and Dubuque being the first points occupied. From these points settlements spread westward, and the growth of the Terri-

tory and State has from that time been rapid and steady.

IOWA CITY, the county seat of Johnson county, Iowa, 120 miles east of Des Moines, is a flourishing manufacturing center and possesses ample railroad facilities. It was the capital of Iowa from 1837 to 1856 and the old State buildings are now occupied by the State University, organized in 1860. The city possesses twelve churches, two national banks, several newspapers, daily and weekly, and a superior system of common schools. Population (1890), 5,628.

IPECACUANHA. The root used in medicine under this name is obtained from *Cephaelis Ipecacuanha*, A. Rich., a small shrubby plant of the natural order *Cinchonaceæ*. It is a native of Brazil, growing in clumps or patches in moist shady forests, and is believed to extend to the Bolivian province of Chiquitos, and the valley of Cauca in New Granada. The drug of commerce is procured chiefly from the region lying between the towns of Cuyaba, Villa Bella, Villa Maria, and Diamantina in the province of Matto Grosso, and near the German colony of Philadelphia, north of Rio Janeiro. Ipecacuanha, although in common use in Brazil, was not employed in Europe previous to 1672. In France within a few years after that date it formed the chief ingredient in a remedy for dysentery, the secret of the composition of which was purchased by the French Government for 1,000 louis d'or, and made public in 1688. The botanical source of ipecacuanha was not accurately known until 1800.

The mode of obtaining the root is thus described by Weddell. The collector or *poayero* grasps the whole of the stems of the *poaya* or ipecacuanha plant in one hand, and loosens the roots by inserting a stick obliquely under them, to which is given a see-saw motion; the adhering soil is then shaken off, and the root placed in a bag. A *poayero* collects on the average about ten to twelve pounds of the root in a day, but sometimes as much as thirty pounds, or as little as six pounds or eight pounds. The root requires to be dried rapidly; it is therefore spread out in the sunshine as much as possible, and at night is covered over to shield it from the dew. In about three days, under favorable circumstances, it becomes dry, and is then broken up, sifted to remove sand or dirt, and packed in "serons," or bales made of cowhide. The root is gathered during the whole of the year, but in less quantity during the rainy season on account of the difficulty of drying the root. As imported, about three packages out of four are damaged by sea-water or damp. The root appears to be possessed of very great vitality. Like other dimorphic plants, ipecacuanha ripens and seeds best when cross fertilized, and presents various forms.

Ipecacuanha root occurs in pieces about two or three lines in thickness, of a grayish-brown or reddish-brown tint externally, having a ringed or annulated surface, and exhibiting a white or grayish interior and a hard, wiry center. It has a faint, rather musty odor, and a bitterish taste. It is usually mixed with more or less of the slender subterranean stem, which has a very thin bark, and is thus easily distinguished from the root. The activity of the drug resides chiefly in the cortical portion, and hence the presence of the stem diminishes its value. The variety imported from New Granada and known as Cartagena ipecacuanha differs only in its larger size and in being less conspicuously annulated. Ipecacuanha owes its properties to the presence of rather less than 1 per cent. of the alkaloid emetine, which, with the exception of traces, occurs only in the cortical portion of the root.

Ipecacuanha is one of the safest and most valuable emetics, being more suitable for administering to chil-

dren than any other. The amount required to produce its effect varies considerably, children, as a rule, being more tolerant than adults: according to Ringer, thirty grains is the average dose for an adult, twenty grains for young children. Its action is rather slow, taking place in from twenty minutes to half an hour after ingestion. Minute quantities of the drug, on the contrary, such as drop doses of ipecacuanha wine every hour or three times a day, according to the urgency of the case, have the effect of checking vomiting arising from natural causes. The nauseating and emetic properties of ipecacuanha are believed to be due to its influencing the peripheral terminations of the pneumogastric nerve, since it produces vomiting even if injected into the blood. In nauseating doses it acts both as a diaphoretic and antispasmodic. It is also a stimulant or irritant of the mucous membranes, and is hence classed as an expectorant, and used successfully in cough, bronchitis, gastric catarrh, and diarrhoea. Some individuals are so sensitive to the action of ipecacuanha as to suffer, even on smelling the drug on entering a room where it is kept, all the symptoms of coryza, hay fever, or bronchitis. In large doses of from sixty to ninety grains, repeated, if required, in ten or twelve hours—the patient lying on his back to prevent sickness or nausea—it is found to be one of the most valuable remedies in dysentery, especially in the epidemic and sporadic forms met with in tropical and malarious countries. Externally applied in the form of ointment, ipecacuanha causes considerable irritation, followed by the appearance of pustules and ulceration.

IPEK, a town of Upper Albania, in the Turkish eyalet of Uskub, situated in the upper valley of the Drin between the mountains Peklen and Koprionik. Population (1890), 12,000.

IPHICRATES, an Athenian general who flourished in the earlier half of the fourth century B.C., owes his fame as much to the improvements which he made in the accoutrements of the peltasti or light-armed troops as to his numerous victories gained by their aid. Increasing the length of their javelins and swords, substituting linen corselets for their heavy coats-of-mail, and introducing the use of light shoes, called after him *Iphicratides*, he increased greatly the rapidity with which these troops could make the sudden forays that were so common in the military tactics of the time. The date of his death is unknown.

IPHIGENEIA is the heroine of several famous Greek legends. She is generally said to be the daughter of Agamemnon, and is also called Iphianassa, though the two are distinguished by Sophocles and by the writer of the *Cypria*. Agamemnon had offended Artemis, who therefore prevented the Greek fleet from sailing for Troy, and could be appeased only by the sacrifice of his daughter. According to some accounts the sacrifice was completed, according to others Artemis carried away the maiden to be her priestess in the Tauric Chersonese, and substituted for her a hind. In this new country it was her duty to sacrifice to the goddess all strangers; and as Orestes came in search of her she was about to sacrifice him, when a happy recognition took place. Iphigeneia is a favorite subject in Greek literature and art. She is the heroine of two plays of Euripides; but none of the many other tragedies founded on her story have been preserved.

IPSWICH, Old Eng. *Gippeswic*, the county town of Suffolk, sixty-eight miles northeast of London by rail, stands on a gentle ascent above the left bank of the Gipping, which widens here into the Orwell estuary. Its lower and older portion, irregularly built, retains some curious specimens of ancient domestic architecture, as Sparrowe's House (1567), with quaint emblematic

moldings of Charles II.'s reign, Archdeacon's Place (1471), and Wolsey's Gateway (1528), sole relic this of one of those "twins of learning," the colleges of Christ Church and Ipswich. Population (1890), 55,000.

IPSWICH, the second most important town of Queensland, Australia, is built on the south side of the river Bremer at the head of navigation, about twenty four miles in a westerly direction from Brisbane. It is the center of a rich pastoral and agricultural district the principal product being maize. Coal is worked on the banks of the Bremer and the Brisbane, and there is a woolen factory in the town. Population, 10,000.

IQUIQUE, a seaport town of Peru, in the department of Tarapaca. In the twenty-five years from 1850 to 1875 it rose from a mere fishing village to be a place of from 18,000 to 20,000 inhabitants. This rapid growth was solely the result of the trade in the nitrate of soda which is found in exhaustless abundance in the neighboring country, and of which during the five years 1874 to 1878 there was annually exported from the province, by way of Iquique, Mejillones, Junin, and Pisagua, an average of 276,811 tons. About sixty or seventy tons of iodine are also manufactured in the nitrate-of-soda factories, varying in proof from 95 to 98 per cent.

IRAK ADJEMI (*i.e.*, Persian Irak), also called JEBAL (Arabic, mountains) and KOHISTAN (Hindustani, mountain-land), is the most important of the eleven provinces of Persia, comprising the larger part of the western half of the country, or upward of 138,280 square miles. To the north lie Azerbaijan, Ghilan and Mazanderan, to the east Khorasan, to the south Farsistan and Khuzistan, and to the west Ardilan and Luristan. The mountains for the most part run west and east, or northwest and southeast. Among the important valleys are those of Hamadan, Ispahan and Yezdikhast. The principal river—though it only belongs to Irak Adjemi in the middle part of its course—is the Kizil Uezen or Sefid Rud, which drains about 25,000 square miles of country, rising between Hamadan and Tabriz, in that part of the Kurdistan highlands which bears the name of Besch Parmak or Pentchangusht (Five-Finger Mountain), flowing north-northeast and then east to its junction with the Hasht Rud, and finally breaking through the Elburz range and finding its way to the Caspian. The country corresponds in large part to the ancient Media.

IRAK ARABI, or IRAK EL ARABI, to which the name Irak is more properly applied, is the district between the Tigris and Euphrates, and from the Euphrates west to the desert, its northern limit being from Anah on the Euphrates to Tekrit on the Tigris. It corresponds to the land of Chaldæa or Lower Mesopotamia. There is a town Irak in the district, about twenty miles east of the Euphrates.

IRAWADI, or IRAWADDY, the principal river in the province of British Burmah, traversing the Pegu division from north to south. The Irawadi is formed by the junction of two streams whose source is yet unknown, in about 26° N. latitude. It reaches the sea by nine principal mouths. The only ones used by sea-going ships are the Bassein and Rangoon mouths. The area of the catchment basin of the Irawadi is 158,000 square miles; its total length from its known source to the sea is about 900 miles, the last 240 of which are in British territory. As far down as Akouk-toung in Henzada district its bed is rocky, but below this sandy and muddy. It is full of islands and sandbanks; its waters are extremely muddy, and the mud is carried far out to sea. The river commences to rise in March; about June it rises rapidly, and attains its maximum height about September. The river is navigable at all

seasons by steamers of light draught as high as the first defile, and during the dry season for steamers drawing six feet as far as the frontier.

The broad channel of the Irawadi has always been the sole means of communication between the interior and the seaboard. From time immemorial the precious stones, minerals, etc., of Upper Burmah, Siam, and the Chinese frontier provinces have been brought down by this route. At the present day the great bulk of the trade is in the hands of the "Irawaddy Flotilla Company," an important English carrying firm; but native boats still maintain a strenuous competition. The flotilla of the company consists of about sixty vessels, including both steamers and flats. Their headquarters are at Rangoon, whence steamers run twice a week to Bassein and also to Mandalay.

IRBIT, a town of European Russia in the government of Perm, seventy miles northeast of Ekaterinburg, at the confluence of the Irbit with the Nitza, a tributary of the Obi. Though the St. Petersburg *Calendar* for 1878 gives the permanent population as only 4,212 (in 1860 the number was 3,408), it is one of the most important trade centers of northern Russia, and during its great fair (February 1-13 to March 1-13) it is visited by upward of 20,000 people.

IRELAND, a large island to the west of Great Britain, and along with it forming the United Kingdom, is encircled by the Atlantic Ocean, and on the east is separated from Great Britain toward the north by the North Channel, whose width at the narrowest part, between the Mull of Cantyre and Torr Head, is only thirteen and one-half miles; in the center by the Irish Sea, whose width is 130 miles; and in the south by St. George's Channel, which has a width of sixty-nine miles between Dublin and Holyhead, and of forty-seven miles at its southern extremity. The island has the form of an irregular rhomboid, the largest diagonal of which, from Torr Head in the northeast to Mizen Head in the southwest, measures 302 miles. The greatest breadth of the island is 174 miles, and the average breadth about 110 miles. The total area comprises 32,535 square miles, or 20,822,494 acres. Territorially it is divided into four provinces—Leinster, Munster, Ulster, and Connaught—and thirty-two counties, the number of counties included in the different provinces being twelve, six, nine, and five respectively. These thirty-two counties are divided into 316 baronies, comprising 2,532 parishes, which are further divided into townlands or plowlands numbering about 60,760, with an average size of over 300 acres each.

The central part of Ireland is occupied by a great undulating plain, whose highest elevation is 300 and average elevation about 200 feet. In the center of the country, from Dublin Bay on the east to Galway Bay on the west, this plain stretches from shore to shore, but toward the south and north it is inclosed by an irregular semicircular belt of mountainous country. The surface of the plain is broken occasionally by isolated hills. Throughout nearly the whole breadth of its extent it rests on the Carboniferous Limestone, and in several places there are remains of the Upper Carboniferous strata or Coal-measures, by which the Carboniferous Limestone was at one time overlaid, and which have been carried away during a vast period of denudation chiefly by the action of subaërial agents. At one period the Carboniferous beds must have extended widely beyond their present limits, and have formed the surface strata of the uplands to the northwest and southeast. In the northwestern highlands of Sligo, Leitrim, and Fermanagh they still form a lofty table-land, which occasionally rises into peaks about 2,000 feet high.

Along the present coast-line there are to be seen in

several places traces of ancient sea margins, the most continuous being those on the northern and eastern coasts, especially in County Antrim. Of still more ancient sea margins there are evidences in the terraces at the base or on the flanks of the mountains. The present coast-line, especially on the west and south, is very much indented by bays and inlets, which Hull, in his *Geology of Ireland*, attributes in many cases to the chemical action of the sea-water on the limestone rocks. On the south coast they most commonly run in a northerly direction with a westerly inclination at the upper end, and on the west coast the direction of the larger inlets is easterly, although several of the smaller ones run north, south, and north-east. Their troughs have mostly been excavated in the synclinal folds of the rocks, which therefore frequently project far into the sea in the form of high and bold headlands. On the northern coast the inlets generally run in a southerly or southwesterly direction. Most of those on the east coast have by the accumulation of sand been either wholly or partly formed into lagoons; and on the south-east coast the sea has made considerable encroachments on the land.

The principal inlets are—on the east coast Belfast Lough, Strangford Lough, Carlingford Lough, Dundalk Bay, Dublin Bay, and Wexford Harbor; on the south coast Waterford Harbor, Dungarvin Harbor, Youghal Bay, and Cork Harbor; on the southwest coast Roaring Water Bay, Dunmanas Bay, Bantry Bay, Kenmare River, and Dingle Bay; on the west coast Tralee Bay, the mouth of the Shannon, Galway Bay, Clew Bay, Blacksod Bay, Killala Bay, Sligo Bay, and Donegal Bay; and on the north coast Sheep Haven, Lough Swilly, and Lough Foyle. In all, Ireland possesses fourteen harbors suitable for the largest ships, seventeen for frigates, and over thirty for coasters, besides an immense number suitable for fishing boats.

The islands of Ireland are small in size, and are situated near the mainland, most of them being formed of rocks from which, according to Hull, the adjoining Carboniferous strata had been denuded by the action of the sea-water. They are most numerous on the west coast, especially opposite Galway, Mayo, and Donegal. Off the Donegal coast the largest is Neish Aran. Separated from the mainland of Mayo by a narrow isthmus is Achill, the largest island of Ireland, and in Clew Bay there is an immense number of islets all formed of drift. An archipelago of granite rocks off the coast of Galway is formed of continuations of the mountains, and at the mouth of Galway Bay are the three islands of Aran, composed of Carboniferous Limestone. Among the picturesque stacks of rocks off the coast of Kerry the most notable are the Skelligs. The largest islands opposite Cork are Dursey Island, Bear Island, and Clear Island, south of which is a picturesque rock called the Fastnet, on which there is a lighthouse. On the east coast the principal are Lambay Island, Innispatrick, and Ireland's Eye off County Dublin, and Copeland Island at the mouth of Belfast Lough. On the northern coast the principal are Rathlin Island off Antrim, and Tory Island off Donegal.

Several of the rivers of Ireland, including the largest of them, have had their channels determined by a previous physical condition of the land surface, and must have been formed during a long period of denudation. Many of the valleys are dried-up river beds, and along various of the present river valleys traces of old river terraces may still be seen. In some cases the alterations of the courses by breaks and dislocations of the strata are of very recent occurrence. In the districts of Sligo and Fermanagh, as well as of Galway, Clare, Kerry, and Cork, the rivers and streams have frequently cut

out subterraneous passages through the limestone, in some cases altogether disappearing; and along their courses *turloughs* or blind lakes, and abrupt deep holes called *sluggas* are frequently formed.

Owing to the moistness of the climate and the lay of the surface of the country, Ireland is more intersected by large rivers than England or Scotland, and it is a remarkable circumstance that in several cases there are groups of rivers with closely contiguous sources, which, however, flow in widely different directions. The largest river is the Shannon, which has its source in the Carboniferous mountains of Fermanagh and Leitrim, and flows southward through Lough Allen, Lough Ree, and Lough Dearg to Limerick, where it opens out into a wide estuary and takes a westerly course to the ocean. Its total length is 240 miles, and it drains an area of 4,544 square miles. The Suir, the Nore, and the Barrow, which have their sources not far from each other in the Slieve Bloom mountains, and unite at Waterford, drain together an area of 3,400 square miles.

The Grand Canal, which with its various branches has a length of 165 miles, connects Dublin with the Shannon at Shannon Harbor; and the Royal Canal, with a length of seventy-six miles, connects Dublin with the Shannon at Cloondora.

Many lakes of considerable extent exist both in the mountainous and lowland districts of Ireland, and the number of small lakes is very great. Altogether the area covered by lakes amounts to 711 square miles, of which 287 are in Ulster, 305 in Connaught, 69 in Munster, and 50 in Leinster. Lough Neagh in Ulster is the largest inland lake in the United Kingdom, and has an area of 153 square miles, with a general depth of from twenty to forty feet. Lough Erne in Fermanagh has a length of upward of forty miles, but a breadth of only eight miles. Properly speaking, it consists of two lakes five miles apart and connected by a river, the upper lake being thirteen miles in length with an area of 9,278 acres, and the lower twenty-four miles in length with an area of 28,000 acres. Both lakes are dotted with numerous islets, and the lower one is famed for its picturesque beauty. The lakes of Killarney in Kerry, which are three in number and closely adjoin each other, are situated in the midst of wild and picturesque mountain scenery. The area of the lower lake is 5,001 acres, of the middle one 680, and of the upper one 430. Lough Dearg, a small lake in the south of Donegal, has been resorted to from time immemorial as a place of penance by Roman Catholics.

Of the Upper Carboniferous beds which at one time overspread the central plain of Ireland, only small patches remain in isolated spots, serving chiefly as an indication of the immense loss that has been sustained in an important element of material prosperity. The principal coal-fields are the Leinster, the Munster, the Connaught, and the Tyrone.

The average quantity of coal raised in Ireland annually is about 130,000 tons, of which about 80,000 are raised in Leinster, 30,000 in Munster, 16,000 in Antrim and Tyrone, and 6,000 in Leitrim and Roscommon. As the annual importation of coal exceeds 2,000,000 tons, it is evident that the coal supply obtained from Ireland's own mines is quite a minor element in its prosperity; but the industry might be much more largely developed, the total available amount of coal being estimated at 180,000,000 tons.

For the absence of coal the country is to some extent compensated by the supply of peat fuel obtained from the red bogs situated in the central plain, and occupying a large tract included within two lines drawn across the island, the one from the Hill of Howth to Sligo, and the other from Wicklow to Galway. Originally

this district was occupied by a forest, principally of oak-trees, which, after being gradually killed by the growth of mosses and other peat-producing plants, were succeeded by a forest of firs, these also in turn perishing. The average depth of the bog is 25 feet, but in some cases it is over 40 feet. According to its depth it varies in color, from whitish brown to a brown-black closely resembling coal. The brown or red turf in the center forms the best fuel. The lower strata sometimes pass into lignite. Lignite of an immense thickness is found around the southern shores of Lough Neagh. In the mountain districts the bogs usually consist of brown turf of only about 12 inches thickness. Preglacial or interglacial peat has been found in Queen's County, County Galway, and County Tipperary, and submarine bogs with remains of an ancient pine forest have been discovered off the southwest coast. The bogs of the central plain contain in a state of good preservation animal and human skeletons, tree canoes, gold and silver coins and ornaments, crannogs or lake dwellings, log houses, and wooden roadways. The total area occupied by bog is 2,830,000 acres, or about one-seventh of the surface of the island, mountain bog occupying 1,254,000 acres, and flat red bog 1,576,000 acres.

The deficiency in coal supply is the more to be regretted in the case of Ireland on account of its immense stores of iron, which for want of proper fuel remain unutilized. Red hematitic iron of a very rich kind is found associated with the coal-fields in the districts of Tyrone, and in Cork and Waterford. Valuable pisolitic ore occurs between the sheets of basalt in Antrim. Iron is met with in great quantities in the bogs, and is easily fusible, but the quality is not nearly so good as that of the clay iron which occurs in great abundance in the coal districts of Connaught. Some centuries ago the manufacture of iron was one of the most important industries of Ireland, the surface of the country being dotted over with small iron-works, in which the ore was smelted by wood charcoal, but as the supply of wood became exhausted the industry was wholly discontinued, the last of the old furnaces having been put out more than a hundred years ago. Of late years iron-mining has been prosecuted with some briskness in Antrim, as well as in Down and Londonderry. But the available supply of coke is wholly insufficient, and until other methods or materials of smelting have been discovered, the valuable iron ores of the country will contribute a very small modicum to its prosperity.

From the gold ornaments and crucible ladles and other implements used in the purifying of gold that have been discovered in a bog on the borders of Limerick and Tipperary, it would appear that that metal was manufactured there at a very early period; and there is a tradition that gold was smelted for King Tighearnmas about 1620 (or 915) B.C., in one of the valleys of the Liffey. About the end of last century a nugget of gold twenty-two ounces in weight was found in a tributary of the Ovoca, and, the government having shortly afterward taken up the enterprise, placer mining was carried on for some years. The gold was from 21 $\frac{3}{8}$ to 21 $\frac{7}{8}$ carats fine, the alloy being silver.

In very ancient times there were silver mines at Argetros, County Kilkenny, and near Toomavara, County Tipperary. The metal occurs both as native silver and in the lead ore, which sometimes yields as much as eighty ounces of silver to the ton. Lead is found in a greater number of localities than any other metal.

The principal copper mines are at Knockmahon in Waterford, at Cronebane and Connary in Wicklow, and at Bearhaven, Ballycommisk, and Cosheen in Cork. Chalcopyrite or yellow copper is the most common, but

melaconite or black copper is found at Cronebane and Connary, and tetrahedrite or gray ore in the small beds to the south of Bearhaven. Native copper is common in most of the districts where the ore is found, and in many places large quantities of copper are collected from the streams by precipitation on iron.

The climate of Ireland is more equable than that of Great Britain, both as regards temperature and rainfall. No district in Ireland has a rainfall rising so high as that of large portions of the Highlands of Scotland, or falling so low as that of several large districts in the east of Great Britain.

In wet years the excessive moisture is very prejudicial to cereal crops, especially in the southern and western parts of the island. Probably the returns either of corn or of green crops would in exceptional cases be very deficient under any mode of culture, and they might on the average, in the southwestern district, be less remunerative than those of grass; but undoubtedly, if tillage were more practised on pasturage farms, the rearing and feeding of cattle would be more satisfactorily performed. Moreover, the soil in many cases is such that most kinds of crops thrive in the moist climate, and much might be done by drainage to procure a drier atmosphere and to mitigate the prejudicial influences of rainfall at the period of ripening. In regard to the natural fertility of the soil, and the ease with which it can be cultivated, Ireland as a whole has great advantages over Great Britain. Strong, retentive clay soils, sandy soils, chalky and gravelly soils, are almost wholly absent, and the mixture of soils resulting from the great variety of stratification, as well as from the detritus carried down to the plains, has created many extensive districts of remarkable richness. The most fertile part of the country is the tract in Munster known as the "Golden Vein," stretching from Cashel in Tipperary to near Limerick. Along the banks of the Shannon there are long stretches of flat lands formed by deposits chiefly of calcareous and peaty matter carried down by floods, and at the estuary of the river this matter has been largely mixed with blue silt deposited by the sea. Extensive districts of similar formation are connected with the Suir, Nore, and Barrow, and with the Bann. In other parts of the limestone plain a rich soil has been formed by the decomposition of drift accumulated by the Esker Sea, mingled in some cases with the remains of granite; and a mixture of a variety of rocks has also greatly benefited many of the other limestone soils. The red bogs contain underneath them abundant marl admirably adapted for use in reclaiming the land. In the districts of the Old and New Red Sandstone, including the greater part of Cork, and portions of Kerry, Waterford, Tyrone, Fermanagh, Monaghan, Mayo, and Tipperary, the soil in the hollows is generally of remarkable fertility. Where gneiss and schist rocks prevail a finely productive soil frequently occurs, resting on inliers of limestone and other calcareous rocks. Indeed, Ireland contains comparatively little irreclaimable land, and even in the mountainous districts which are unsuitable for tillage there is often soil sufficient, with the aid of the moist climate, to yield pasturage of superior quality in great abundance; and more than two-thirds of the surface of the country, being less than 500 feet above sea-level, possesses a temperature well adapted to all the usual kinds of crops.

But, although enjoying such favorable natural conditions, Ireland as a whole lags far behind most other portions of the United Kingdom in agricultural progress, both as regards the circumstances of the peasantry and the development of the capabilities of the soil for producing food. The causes of this state of things are somewhat complex; and, having their chief connection

either directly or indirectly with the procedure of the legislature, they have been in operation for several centuries, during which, instead of diminishing in influence, they have apparently gained strength by intermixing and entangling with each other. Until a comparatively recent period the system of landholding in Ireland was the tanistry or communal, governed by the ancient Brehon code. According to this code the land belonged primarily to the tribe or commune, and was vested in the chief or tanist, who, from his rank as a noble, held a portion of it as his own property, had a life interest in a second portion from the office to which he had been elected, and possessed jurisdiction over a third portion, the communal land, which was divided annually. The nobles from among whom the tanist was chosen had the right of ownership of land, another class had the right of ownership of chattels, which went to the sons by gavelkind. Only certain classes of the tribe--the Saer Céili or "free tenants," and Daer Céili or "base tenants"--could obtain security of tenure for life, the others being either yearly tenants, free laborers, or slaves. The interests even of the yearly tenant were preserved by stringent regulations, and in the course of generations it was possible to rise from the lowest social grade to the rank of a "free tenant." The lands of the tenants went to their male descendants by gavelkind. Even the free laborers and the slaves, with the exception of those who were convicts or prisoners, had the right of sustenance and shelter on the estate of their lord. Unlike those of Great Britain, the ancient laws of Ireland remained uninfluenced by Roman legislation; and, although the Danish invasions caused some disturbance of the old order of things, the regulations so far as the possession and tenure of land were concerned remained practically unmodified until the invasion of Henry II. The natural consequence was that the pastoral mode of life associated from the beginning with the Brehon code should also remain unchanged, the more especially as soil and climate alike were favorable to the growth of luxuriant pasturage; but, as pastoral employment is that which is least able to support a dense population, a large proportion of the servant class gradually sank into a condition of idleness and wretched poverty. Unhappily the result of the Anglo-Norman invasion was not such as to improve this state of things by the gradual influence of other laws and customs, but to introduce into the social system disturbing and irritating elements, which kept alive all the old evils in a more aggravated form. Henry II. nominally bestowed the entire land of Ireland upon ten of his followers, but practically, with the exception of the small district of the Pale, it remained in the possession of its ancient lords. Confiscations became more frequent as the power of the English increased, and within that portion of the territory over which English rule did not extend the tenants and laborers, in the unsettled condition of society, suffered severely from the irresponsible authority of the nobles. Henry VIII., the first English sovereign who really held sway over the whole island, induced the nobles to acknowledge him on condition that their ancient rights and privileges were left intact; but this arrangement was set aside by Elizabeth, whose reign was signalized by the great wars, resulting in the composition of Connaught and the planting of Munster. By the former of these, while possession was secured to the nobles in their estates, the lands in the province were alienated from the clan to the chief, and the free tenants became virtually proprietors of their farms; and by the latter 574,628 acres, the estate of the earl of Desmond, were parceled out to be peopled according to a plan founded wholly on English customs. Soon after the accession of James I. in 1603, tanistry and gavelkind

were abolished by decision of Queen's Bench, and the estates of the Ulster nobles—511,465 acres in extent—were forfeited to the crown, to make way for the great plantation of Ulster. The custom of gavelkind was, however, revived by the act of Queen Anne against the Catholics, and the statute was not repealed till the reign of George III. The confiscations were repeated on a larger scale during the Stuart and Cromwellian periods, from which time may be dated the complete practical overthrow of the Brehon system except in Ulster and a few isolated districts where the shadow of it still lingers in the custom known as tenant-right. Even, however, after the subjugation of Ireland by Cromwell, Sir William Petty, in his *Political Anatomy*, written in 1672, estimated the value of the tenant's claims for improvements and benefit of leases at one-third of his annual rental. The same writer calculated that, whereas in 1641 about two-thirds of the good land belonged to the Irish or Catholics, at the time he was writing the proportion was as nearly as possible reversed, the figures being as follows: Purchased by the Protestants of Connaught of the transplanted 80,000 acres, possessed by the English and Protestants and Church 5,140,000, possessed by the Irish 2,280,000. Of the 1,100,000 inhabitants, the proportion of Irish to English was as nine to three; and six out of every eight of the Irish lived in a "brutish, nasty condition." After the confiscations which followed the wars of William III., the Catholics did not possess more than one-seventh of the soil. The penal laws by which the Catholics were disabled from holding freehold property tended to effect a still further transference of proprietorship to the Protestants. The functions of the proprietor were generally performed by the large Protestant tenant, to whom a long lease of the property was granted and who sublet to the Irish farmer. Frequently the farms were subdivided and sublet to the third, fourth, or fifth degree, and, as the Catholics were disabled from holding leases for more than thirty-one years, and at less than two-thirds of a rackrent, they necessarily occupied the lowest step in this peculiar social scale. Instead of an industrious and thriving class of peasant proprietors, which the Brehon system left to itself would in all probability have gradually developed, a race of wretched cotters sprung up, whose only inheritance now guaranteed to them by the remains of the old Brehon system was their deep-seated conviction as to their inalienable rights to the soil; the custom which, without now recognizing these rights, threw upon them the expense not only of fencing, draining, and other improvements, but of the erection of all the dwellings on the farm; and their dependence on the proprietor, one, however, who was now generally an alien, and from whom they held their small patches of soil on payment in labor according to conditions strung to the utmost degree of severity by the process of subletting and an unlimited competition. Support by any other form of industry than agriculture was rendered impossible by laws which practically paralyzed the commerce and manufactures of the country, and agriculture itself was additionally hampered by the enactments passed in the reign of Charles II. against the exportation to England of cattle, sheep, and pigs, of salt beef and bacon, and even of butter and cheese. These enactments, combined with that final one by which the prohibition formerly passed against the exportation of woolen manufactures to England or the colonies was extended also to foreign countries, caused the "middle men" to turn their attention to woolen smuggling; and, finding it a more lucrative means of livelihood than that of squeezing money from impoverished tenants, they in many instances drove the cotters

from their farms, which they changed into sheepwalks.

The acts of 1771, 1778, and 1782, which removed the Roman Catholic disabilities in regard to the holding of leases and property, and the act of 1793, which extended to the Catholics the forty shillings franchise, had, on account of the peculiar social condition created by former legislation, practically as disastrous effects as even the penal laws which they superseded. The landlords for election purposes created an immense number of the lowest kind of freeholds, which they let at exorbitant rents owing to the high price of provisions during the great war. These prices indeed gave a temporary stimulus to agriculture, and led to the conversion of a considerable amount of pasturage into tillage, but practically the position of the freeholder was more servile than that of the previous tenant-at-will, and when prices sank to their normal rate at the close of the war he found himself in a condition of absolute ruin. At the same time, by this minute subdivision of leaseholds, an immense increase had taken place in the agricultural population, whose numbers could perhaps scarcely have found support under any system of agriculture, although undoubtedly under a system of peasant proprietorship support would have been possible to a much larger number, inasmuch as the principal profits of tillage would have fallen into the hands of the tillers of the soil instead of those of absentee proprietors. To aid the landlords in freeing themselves from the incubus of impoverished tenants an Eviction Act was passed in 1816, and further protection was afforded them by the Subletting Act of 1826, but it was not until after the abolition of the forty shilling leasehold suffrage in 1829 that any important diminution took place in the leaseholds. Under tenant-at-will, which was then generally substituted, the subdivision of holdings was not materially diminished, although for some years previous to the occurrence of the potato blight and the repeal of the corn laws more than one-fourth of the population stood in need generally of relief, and the landlord, in order to escape the burdensome taxation consequent upon the Poor Law Act of 1838, had begun the transformation of small holdings into large farms.

The potato blight and the repeal of the corn laws, occurring nearly simultaneously, caused an immediate and almost complete sweep to be made of the smaller class of holdings. The consequence was an enormously rapid diminution of the population, which made whole districts of the country almost tenantless, but which, great as it was, only removed the abnormal strain of hardship under which the peasant was suffering, and brought him no permanent relief from his burdens by an increase of wages or more favorable terms of occupancy. Indeed, tenancy-at-will was still further increased by the Parliamentary Votes Act of 1850, which granted the suffrage to those who for twelve months were rated as occupiers of land valued at £12 a year.

One of the chief obstacles to agricultural improvement in Ireland has been the unsatisfactory relations between landlord and tenant. The legislation bearing on the subject has been of a very various and contradictory character. There are no official records of evictions earlier than 1849. A special return presented to the House of Commons in April, 1881, gives by provinces and counties the number of evictions for each year from 1849 to 1880, as ascertained by the police. The numbers are of course only approximately correct, but err by defect, not by excess. The total number of families evicted during that period was 90,107, comprising 460,570 persons; but of these, 21,340 families, comprising 115,859 persons, were readmitted. Deducting readmissions, the numbers in 1849 were 13,384

families, 72,065 persons; in 1850 they were 14,546 families, 74,171 persons; in 1851 they declined to 8,815 families, 43,449 persons; and they gradually diminished until 1856, from which year until 1862 the numbers though fluctuating fell short in each year of 1,000 families. There was a considerable diminution from 1865 till 1878, when they rose to 834 families, or 3,916 persons, while in 1879 the numbers were 1,098 families, 5,576 persons, and in 1880 they were 1,893, or 9,036 persons. During the half year ending June 30, 1881, the numbers evicted were 1,433 families or 6,557 persons. In 1865 it was enacted that no evictions should take place without the intervention of the sheriff; but, although a means was thus supplied of obtaining records absolutely correct, the sheriffs in some instances neglect to send in returns. The large increase of ejectments since 1870 shows that the Landlord and Tenant Act of that year has failed in ordinary circumstances to improve the relations between landlord and tenant; and, while some of its provisions have had in certain respects a beneficial effect, it has also exercised a variety of prejudicial influences, and not only broke completely down under the strain of the famine of 1879, but in many cases led to the almost unavoidable infliction of great hardship on the tenant. The salient principle of the act was the abandonment of the position assumed in the act of 1860, which endeavored to place the relation of landlord and tenant on the simple basis of contract. Stated positively, its leading features were the legal confirmation of the Ulster tenant-right and other ancient customs, the provision made for compensation for loss on quitting and for improvements, and the sanctioning of grants on loan and other facilities to tenants to aid in the purchase of their holdings. Since the passage of the act the average sum adjudged annually in cases between landlord and tenant has been over £18,000, of which more than a third has been for Ulster tenant-right. The amount adjudged annually has varied considerably but irregularly, and of late years there has been a diminution in the number of cases.

To remedy the defects of the act of 1870, a new act was passed in 1881. Practically it secures to the tenant a near approximation to the "three F's"—"free sale," "fair rent," and "fixity of tenure." "Free sale" is granted so far as is compatible with a due regard to the rights of the proprietor. The "fairness" of a rent may be decided by the "intervention of court," and, while on certain conditions a "fixed tenancy" may be agreed upon between landlord and tenant, an approximation to this is obtained in other cases by provisions in regard to rent and "compensation." Additional facilities have also been given to tenants to purchase their holdings, and provision has been made for grants of money to aid in the reclamation of land and in emigration. A feature of the act is the creation of a land commission as a supreme court of appeal, except in special cases, in questions between landlord and tenant, and with the power of sanctioning loans.

Leases are not held by so many as one-tenth of the total number of farmers, tenancy-at-will being preferred, partly for the freedom it allows, and partly because it is thought to involve a tacit consent to permanent occupancy.

One of the chief hindrances to agricultural progress in Ireland has been absenteeism. According to Sir William Petty, who wrote in 1672, one-fourth of the real and personal property of Ireland was possessed by absentees. Prior, in his *List of Absentees*, published in 1729, divides them into three classes—those who are seldom or never seen in Ireland, those who visit Ireland for a month or two, and those who are occasionally

absent. Arthur Young gives the rental of absentees in his time as £732,200 (about \$3,600,000), or about one-seventh of the whole estimated rental, and Swift declared that one-third of the rental of Ireland was spent in England. Absenteeism continued to increase until the close of the great war in 1816, and although it diminished from that time, a substitute for many of its evils was supplied by the rapid impoverishment of a large number of idle and extravagant squireens. To help in freeing the country from this incubus, an act was passed in 1848 to facilitate the sale of encumbered estates in Ireland, which, however, proved wholly ineffectual, and was superseded by another in the following year appointing a commission of three persons to constitute a court for the purpose. This court commenced its sittings in October, 1849, and, from that period until it closed its sittings in August, 1859, 3,547 sales were effected, the gross amount of which was £25,190,839 (\$127,000,000). In 1859 the court was reconstituted on a permanent footing under the title of the "Landed Estates Court," power being conferred on it to deal with unencumbered as well as encumbered estates. Up to January, 1880, the sales in this court amounted to £27,277,140 (\$136,000,000), so that probably about one-sixth of the whole area changed hands through the action of the two courts.

Though Ireland is without the stimulus to industry produced by an abundant supply of coal, yet with its great command of water power it might have widely developed its manufactures before the introduction of steam, had not special causes been in operation to check their progress. The unsatisfactory political and social relations of the country, and the unhappy legislation which had blighted its agriculture, would necessarily in any case have indirectly stunted its manufactures also; but, in addition to this, they were specially discouraged by various restrictive and repressive Acts. For a considerable period after the Anglo-Norman invasion Ireland was, however, in this respect placed on an entire equality with England, and in acts passed in the reigns of Edward I., Edward III., and Edward IV. is specially exempted from the duties or prohibitions imposed on foreign manufactures.

At an early period the woollen manufactures of Ireland were exported in considerable quantities to foreign countries. Considerable impulse was given to the manufacture in the reign of James I. by the establishment of a colony from the Palatinate, in Germany, at Carrick-on-Suir, but in the reign of Charles I. the clothing trade was discouraged by the earl of Strafford, lord-deputy, who, to prevent it interfering with that of England, endeavored to foster the linen manufacture instead. The act of the twelfth of Charles II., which prohibited the export of raw wool both from Ireland and England to foreign countries, was in the case of Ireland not only harmless but ineffectual; but, in addition to this, Ireland was virtually debarred from the English market by the heavy duties imposed on her woollen manufactures, and, being left out in the Navigation Act of 1663, she was also debarred from the colonial market. The foreign market was, however, left open to her; and after the prohibition of the export of Irish cattle to England the Irish farmer was led to turn his attention to the breeding of sheep, when not only did the woollen manufacture increase with great rapidity, but, owing to the superiority of the wool, the materials manufactured were of such a quality as to awaken the alarm of the English manufacturer, at whose instance both Houses of Parliament petitioned William III. to come to the rescue. In accordance with his wishes, the Irish parliament in 1698 imposed additional heavy duties on all woollen clothing with the exception of

friezes exported out of Ireland, and in the following year an act was passed by the British Government prohibiting the export from Ireland of all woolen goods to any country save England, to any port in England save six, and from any town in Ireland save six. Sir William Petty in 1641 estimated the number of woolen workers and their wives at 30,000, but the result of these acts was so disastrous as practically to annihilate the manufacture, to reduce large districts and towns to the last verge of poverty, and seriously to cripple the revenues of the kingdom. Notwithstanding, however, that Ireland ceased to make even for her home supply any but the coarser articles, and was forced to import her finer goods from England, the acts were almost as injurious to the English as to the Irish manufacturer; for not only did many of the skilled Irish workmen settle in France, Spain and the Netherlands, but by means of smuggled Irish wool, to the extent of four-fifths of the Irish fleeces annually, the foreign manufacturer was able at a much smaller cost to fabricate materials quite equal to those of England, and for a time almost to swallow up her Turkey wool trade.

Between 1779 and 1782 the various acts which had hampered the woolen trade of Ireland were repealed or greatly modified; but, although a temporary impulse was thus given to the manufacture, the imprudent manner in which it was prosecuted and the influence of the remaining statutes led in the majority of cases to disappointment, and after a short period of deceptive prosperity, followed by failure and distress, the expansion of the trade was limited to the supply of the home market.

The linen manufacture of Ireland has suffered from legislation chiefly indirectly—from the trade restrictions which hampered the commerce of the country generally, and from the depressing influence of an unsatisfactory social system and unfavorable agricultural relations. At a very early period flax was to some extent cultivated in Ireland, and was both spun into thread, which was exported to foreign countries, and manufactured into cloth, which was made use of for cloaks, for the head-dresses for women, and for shrouds. The Earl of Stafford, lord-deputy in the reign of Charles I., with a view both to discourage the woolen manufacture of Ireland and to obtain for England a cheaper supply of linen than was to be had from France or Holland, as well as probably to benefit himself, invested as much as £30,000 (\$150,000) of his fortune in the promotion of the linen trade, and not only imported flaxseed in large quantities from Holland, but offered premiums to induce skilled workmen from France and the Netherlands to settle in Ireland. A similar policy was vigorously prosecuted by his successor the duke of Ormond, who in 1665 procured the passage of an act by the Irish parliament to encourage the growth of flax and the manufacture of linen. In addition to this he dispatched persons to the Netherlands to obtain a knowledge of the best mode of manufacture, and he brought over a number of families from Brabant and others from France and Jersey, whom he settled at Carrick and at Chapelizod near Dublin, in both which places he established flourishing factories. Following the same line of policy, an act was passed by the English parliament inviting foreign workmen to settle in Ireland, and admitting all articles made of flax or hemp into England duty free, a privilege which, according to the report of the Irish House of Commons in 1774, gave Ireland an advantage over foreign nations of 25 per cent. In 1698 the Irish parliament, in answer to the representations of England, promised that they would "heartily endeavor to establish a linen and hempen manufacture," but this promise was at first

only fulfilled by levying prohibitory duties on the exports of woollens.

The Linen Board ceased to act in 1830, the trade having since 1825 been in a very depressed condition owing to the importation of English and Scotch yarns made by machinery, which undersold the home-made article. A flax-spinning factory had indeed been erected at Cork in 1805, but appears to have been unsuccessful, and no further attempt to introduce machinery seems to have been made until after the discontinuance of the Linen Board, when an experiment on a large scale was made on the Bann near Belfast, from which period may be dated the rise of the great linen trade of Ulster, where, with the gradual disappearance of the hand spinning in the other provinces, nearly the whole linen manufacture of Ireland became concentrated. It is in the province of Ulster that flax is chiefly grown, but the soil has in many instances been much deteriorated by a too frequent rotation of the crop. The flax of Irish production in 1880 was estimated at 24,508 tons, of British production at 1,398, while the foreign imports of flax into the United Kingdom amounted to 94,812 tons. The cessation of the duties on exports from Ireland to Great Britain deprives us of the means of tracing the progress of the modern development of the linen industry. It was calculated that in 1855 the total exports of linen from Ireland to Great Britain and foreign countries was 106,000,000 yards, valued at £4,400,000 (\$22,000,000), and undoubtedly since that period it has more than doubled. According to the report of the Flax Supply Association of Belfast for 1876, it was estimated that in 1875 the consumption of fiber in all the mills of Ireland was about 45,897 tons, or about one-seventh of that consumed by all the flax-mills in existence. It was also estimated that the total quantity of yarns produced per annum was 21,373,700 bundles, of which 10,479,040 were supposed to be manufactured into cloth by power-looms, and 5,850,000 by hand-looms, in addition to which about 2,000,000 bundles were supposed to be imported from Great Britain and the Continent, leaving for export 7,044,660 bundles—fully two-thirds of the production and imports into Ireland of yarn being converted into linen fabrics in Ireland. According to the report made to parliament in 1837, the number of workers employed in the flax factories of Ireland was 7,810, and according to the returns relating to factories for 1839, the number of mills engaged in the manufacture was forty, employing thirty-two steam engines with a horse-power of 928, and thirty-seven water-wheels with a horse-power of 1,052, the total number of persons employed being 9,017. In 1880 there were 1,182 scutching mills, a decrease of 317 as compared with 1871. The number of persons employed in the jute and hemp factories is over 1,000.

The cotton manufacture was introduced into Ireland in 1777, and a mill for spinning twist with water-power was erected in 1784. Under the protection of high import duties and bounties the manufacture increased with such rapidity that in 1800 it gave employment to 13,500 workers, chiefly in the neighborhood of Belfast. At the Union it was arranged that the duties, which then stood at 68 per cent. *ad valorem*, should remain unchanged for eight years, when they were gradually lowered by eight annual reductions, until in 1816 they stood at 8 per cent., and were shortly afterward abolished. The manufacture suffered greatly during the famine of 1846, and in 1850 the number of factories was only eleven, employing 2,937 persons. In 1861 the number had declined to nine, employing 2,734 persons, and, although in 1870 it had risen to fourteen, employing 4,157 persons, the check experienced during

the American war has never been surmounted, the number of factories in 1874 being only eight, employing 3,075 persons, and in 1879 declining to six, employing 1,620 persons. For some time a large manufacture of lace and sewed muslin has been carried on in Ulster and some parts of Munster and Connaught—the sewed muslin trade being much the more extensive of the two. More than 300,000 persons, chiefly females, are employed in it, many of them being girls in the convent schools. Of late the trade has, however, been declining.

For several centuries Ireland has rivaled Scotland in the manufacture of whisky, the spirit of each country having its own special excellences. Camden states that in Ireland usquebaugh was much used to stop the fluxes and catarrhs caused by the excessive moisture of the climate, and that the Irish spirit was much “less heating and more drying” than that of England. An excise duty was first imposed on the manufacture in 1861, the rate charged being 4d. per gallon. This was raised in 1715 to 7d., and in 1717 to 8d. The amount of spirits produced by distillation avowedly illicit vastly exceeded that produced by the licensed distilleries. According to Wakefield, stills were erected even in the kitchens of baronets and in the stables of clergymen. More commonly they were placed in retired districts on loose stones, so as to be easily removable on the approach of the revenue officers.

There are breweries in most of the large towns of Ireland, and Dublin is celebrated for its porter. In 1888 the number of common breweries was fifty-three, and of licensed victualers 16,686, the malt consumed by the former being 3,965,887 and by the latter 1,864 bushels.

The fisheries of Ireland are of considerable economic importance, but have greatly diminished of late years. The salmon fisheries employ between 11,000 and 12,000 persons. The deep-sea and coast fisheries now employ only about 6,000 boats and 20,000 persons, whereas the numbers in 1860 were 13,483 and 55,630 respectively.

So far as natural advantages for commerce and shipping are concerned, Ireland is scarcely rivaled by any other country. Her coast is not only surrounded by safe anchorages, but the land is so deeply indented by bays and inlets, and so intersected by a network of internal navigation, that no part is more than twenty-four miles from water communication with the sea. In regard also to situation, it is difficult if not impossible to fix on a country whose circumstances are more favorable. Lying contiguous to the coast of Great Britain, and at some points almost touching it, she is nearer than that country to the West Indies, the continent of America, the west coast of France, the coasts of Spain and Portugal, and the ports of the Mediterranean. There is abundant evidence to show that Ireland was prepared to make use of these advantages, and that only impolitic trade restrictions have prevented her from developing a commerce which would undoubtedly have vied with that of Great Britain, but from which Great Britain would have gained more than she was in dread of losing. These restrictions, however, imposed when the great manufacturing industries of modern times were in their early infancy, not only snatched from her the possibility of commercial greatness, but, operating along with other legislation, doomed her to agricultural stagnation and centuries of poverty and distress; so that in fact contiguity to Great Britain has proved to be to her a bane rather than a blessing, and America, instead of affording her the means of enrichment, has only supplied her with an asylum for her poverty-stricken sons.

Revenue and Expenditure.—Until the time of Henry VIII. the English rule in Ireland was only nominal,

except within a very small district; and, while statistics as to the revenue would thus be of little advantage for comparison with later times, they are not obtainable except in a very fragmentary manner.

From a variety of circumstances it is difficult to arrive at an approximate estimate of the wealth of Ireland; and there is no proper basis for a comparison with the other portions of the United Kingdom—among other reasons from the fact that by far the largest part of the wealth of Ireland is derived from agriculture.

The railway from Dublin to Kingston, which was opened in the end of 1834, was the first and for several years the only railway in Ireland. For a comparison with England and Scotland see ENGLAND; it will be observed that the proportion of traffic in relation to population is very much smaller in Ireland.

The great increase of population which began toward the close of last century, and continued during the first forty years of the present one, was due in various degrees to improvements in the political condition of the country, to the creation of leaseholds after the abolition of the forty shillings franchise, and to the prosperity caused by the productiveness of the potato and the high prices of produce during the war with France. The decrease from that period began at first with great rapidity, owing to the pressure of famine, and has been continuous up to the present time, chiefly owing to the creation of large pasturage farms.

The figures for 1841 indicate a density of population which is unparalleled, considering that it is so largely rural. The collective population in the parliamentary boroughs was 804,705 in 1841, 878,430 in 1851, 788,866 in 1861, 856,788 in 1871, and 892,505 in 1881. The increase of the urban population between 1841 and 1851, while there was a large decrease in the population generally, was apparently owing to a large temporary influx of the rural population into the towns, as in 1861 a large diminution had taken place, the increase of manufactures, however, causing the loss to be nearly recovered in 1871. Excluding the Dublin suburban townships of

Population of Ireland, 1659–1881.

	Pop.	According to		Pop.	According to
1659	500,091	Census return.	1792	4,088,226	Beaufort.
1672	1,320,000	Sir Wm. Petty.	1805	5,395,456	T. Newenham.
1695	1,034,102	Capt. South.	1814	5,937,856	Parl. returns.
1725	1,669,644	Arthur Dobbs.	1821	6,801,827	{ Census com- missioners.
1731	2,010,221	Estab. clergy.			
1754	2,372,634	Tax collectors.	1831	7,767,401	“
1760	2,317,384	De Burgo.	1841	8,196,597	“
1767	2,544,276	Tax collectors.	1851	6,574,278	“
1777	2,690,556	“	1861	5,798,564	“
1785	2,845,932	“	1871	5,412,377	“
1788	4,040,000	G. P. Bushe.	1881	5,159,839	“
1791	4,206,612	Tax collectors.			

Rathmines (24,245) and Pembroke (23,184), there were only six towns whose population in 1881 was over 20,000.

The population of Ireland has at various periods been considerably diminished by outbreaks of pestilence and by famine, but its decrease is chiefly attributable to emigration. Since 1847 this has been annually so great as to cause a continuous diminution of population. The census commissioners estimated the emigration between 1821 and 1831 at 70,000. The total number who emigrated between 1831 and 1841, according to information collected at the various ports, and corrected by comparison with other statistics, was 403,459 (with an addition of 10 per cent. on account of imperfect returns), the number who emigrated from Irish ports being 214,047, and from Liverpool 152,738. Information as

to the destination of the emigrants for these years is available only in regard to those emigrating from Irish ports, the numbers who left for British America being 189,225, for the United States 19,775, for the Australian colonies 4,553, and for other destinations 494. The census commissioners of 1851 obtained information from the different ports of the United Kingdom regarding the numbers and destination of Irish emigrants from 1841 to 1855. The returns of emigration and immigration from and into the United Kingdom give full information regarding the destination of emigrants of Irish birth from 1853.

The influence of the great famine is very evident in the numbers emigrating between 1846 and 1852, the average being three times that of the preceding period, and more than double that of the period from 1853 to 1860. Although also the impulse toward emigration had begun even before 1846, and must be regarded as part of a general tendency toward emigration then prevalent in Europe, and especially in the United Kingdom, it was doubtless strengthened in Ireland by special circumstances which are still operating so as to cause an annual diminution of the population. The number who emigrated in 1841 was only 16,376, and in 1847 it rose to 215,444, more than double that of 1846. The highest number in any year was 249,721 in 1852, and the smallest since 1852 was 22,831 in 1877, the numbers increasing in 1879 to 41,296, and in 1880 to 93,641. This statement, however, gives the number of emigrants not from Ireland but from the United Kingdom, and of course includes many of Irish birth who had been for some time living in Great Britain.

More than two-thirds of those leaving Ireland for foreign countries emigrate directly to the United States, but to these must be added the large numbers who sail to Canadian ports, and journey thence by rail.

The usual theory that the poverty of the Irish is due to early marriages, or to the fact that a larger number marry than in Scotland or England, can be proved by statistics to be wholly unfounded. The average annual number for the ten years ending in 1879 of male minors married was only 2.65 per cent. of the total males married, and in the case of females the percentage was only 12.26, a much smaller proportion than in Great Britain; and in 1871 the proportion per cent. of the unmarried population above fifteen years was in Ireland—males 47.85, females 42.38, the proportion in England and Wales being 38.40 and 36.14 respectively, and in Scotland 44.41 and 42.23. In proportion to the number of married women between seventeen and fifty-five years of age, the number of births is very similar to that in Great Britain. The number of illegitimate births is very small, the yearly average for the last ten years being about 2.5 per cent. The proportion of the sexes born is about 106 males to 100 females.

The executive government is vested in a lord-lieutenant, assisted by a privy council, and by a chief secretary, who is a member of the House of Commons and frequently also a member of the cabinet. In the absence of the lord-lieutenant his functions are discharged by lord-justices, those generally appointed being the lord-chancellor and the commander of the forces. Each county is in charge of a lieutenant, a number of unpaid deputy-lieutenants and magistrates, and one or more resident paid magistrates, all appointed by the crown. The counties of cities and towns and the boroughs are governed by their own magistrates. The judicial establishment consists of the high court of chancery, the court of Queen's bench, common pleas, and exchequer, the landed estates court, and the probate and matrimonial court, which since 1877 constitute the high court of justice: the court of appeal; the high court of

admiralty, which is to be abolished after the death of the present judge; and the court of bankruptcy and insolvency. The decisions of the court of appeal are subject to an appeal to the House of Lords. Assize courts are held in each county by two judges, for which purpose the country is divided into six circuits.

Ireland is represented in the imperial parliament by twenty-eight temporal peers elected for life and 103 commoners.

In Ireland there are four military districts, the headquarters of these being Dublin, Cork, Curragh, and Belfast respectively, and eight military subdistricts, with depôts at Downpatrick, Omagh, Armagh, Naas, Birr, Galway, Clonmel, and Tralee. The Irish militia consists of twelve regiments of artillery, twenty-one regiments of infantry, and fourteen rifle corps, numbering when embodied over 31,000 men and officers.

The parish constables of Ireland were in 1814 superseded in proclaimed districts by a peace preservation force, and in 1822 an Act was passed authorizing the formation of a constabulary force of 5,000 men, under an inspector-general for each province. In 1836 the entire force was amalgamated under one inspector-general. In all, it numbers between 10,000 and 12,000 men. In addition to the usual duties of policemen, the police are intrusted with the collection of statistics, the preservation of fish and game, and a variety of services connected with the local government. The average annual expense is a little over £1,000,000 (\$5,000,000). In addition to this force there is the Dublin metropolitan police, consisting of about 1,100 officers and men, who are maintained at an annual cost of over £130,000 (\$650,000), the expense borne by the Consolidated Fund being over £80,000 (\$400,000).

According to the census returns of the commissioners of public instruction in 1834, there was a total population of 7,943,940 inhabitants, of whom 852,064 belonged to the Established Church, the number of Roman Catholics being 6,427,712, of Presbyterians 642,356, and of persons of other denominations 21,808. The population in 1881 was 5,159,839. Comment is unnecessary.

The Anglican Episcopal Church of Ireland constituted until 1871 an integral portion of one church, known as the Church of England and Ireland, and established by law in the two countries; but the Irish branch was disestablished and disendowed by an act which received the royal assent on July 26, 1869. According to this act, which came into execution on January 1, 1871, all church property became vested in a body of commissioners. All the state grants were to be resumed by the state, provision being made for vested interests, but the church was to receive possession of all endowments obtained from private sources since 1660. To all incumbents the income they formerly possessed was secured for life, minus the amount they might have paid for curates; and compensation was also granted to curates, parish clerks, and sextons, to Maynooth Roman Catholic College in lieu of the continuance of the annual parliamentary grant, and to the Presbyterians in lieu of the continuance of the grant called "Regium Donum."

The Roman Catholic Church is governed by four archbishops and twenty-seven bishops, the number of parish priests being nearly 1,000, and of administrative curates about 1,750. The ecclesiastical parishes amount to 1,084, and the churches and chapels number nearly 2,500. The Maynooth Roman Catholic College, which was founded in 1795, originally received an annual vote from government of £8,000, but latterly a grant from the consolidated fund of £26,360, which was commuted by the payment of £372,331.

The Presbyterian Church, which has its principal

adherents in Ulster, was originally formed in 1642, and in 1840 a union took place of two divisions of the church which had formerly separated. Previous to the disestablishment of the Church of Ireland Presbyterians received for the support of their ministers an annual sum, first granted in 1672, of about £40,000, known as "Regium Donum," which was commuted by the Church Disestablishment Act.

The Methodist Church of Ireland was formed in 1878 by the union of the Wesleyan Methodists with the Primitive Wesleyan Methodists. The number of ministers connected with the conference in June, 1880, was 240, of whom 40 were supernumeraries. The number of principal stations under the charge of ministers was 135, embracing 373 chapels. The number of persons connected with the other denominations of Ireland is inconsiderable, amounting, in 1881, to only 0.8 per cent.

The number of persons in 1871 who could speak Irish only was 103,562, the number in 1841 being 319,602, and the number who could speak both Irish and English was 714,313 in 1871 and 1,204,684 in 1841.

According to the census of 1871 the number of schools for primary instruction was 9,495 with 615,785 pupils, of superior schools 574 with 21,225 pupils, of universities and colleges 13 with 2,945 students. The oldest university is that of Dublin, established in 1591 by a charter of Queen Elizabeth. The Catholic University, founded in 1854, has in operation faculties of medicine, philosophy and letters, and science. Queen's University, established in 1850, with colleges at Belfast, Cork, and Galway, has faculties of law, arts, medicine, and engineering. Queen's University has been superseded by the Royal University, for which a charter was granted in 1880. A royal college of science was established in 1867, with departments of mining, agriculture, engineering, and manufactures. The higher education of women is represented by Alexandra College, Dublin, founded in 1866, the Governess Association, the Ladies' Institution of Belfast, and the Queen's Institute for the instruction of women.

In 1811 a society was formed in Ireland for the education of the poor, which, from 1819, received the assistance of a grant of public money. This, however, was withdrawn in 1830 on account of the Roman Catholics refusing from religious objections to allow their pupils to enter the schools of the society. In 1833 the money formerly given to the society was vested in commissioners of public education, who in 1845 were incorporated under the name of the "Commissioners of National Education of Ireland."

HISTORY.—Circumstances were favorable in Ireland to the growth and preservation of ethnic legends. Among these favorable circumstances were the long continuance of tribal government, and the existence of a special class whose duty it was to preserve the genealogies of the ruling families, and keep in memory the deeds of their ancestors. Long pedigrees and stories of forays and battles were preserved, but under the necessary condition of undergoing gradual phonetic change according as the popular language altered. During many centuries there had been no conquest by foreign races to destroy these traditions; internal conquests and displacements of tribes confuse but do not eradicate traditions and pedigrees. When the Irish were converted to Christianity and became acquainted with the story of the deluge, the confusion of tongues, and the unity of the human race, the *súide* (sages) naturally endeavored to fill up the gap between their eponyms and Noah. The pedigrees now began to be committed to writing, and, as they could for the first time be compared with one another, a wide field was opened to the inventive

faculties of the scribes. The result has been the construction of a most extraordinary legendary history, which, under the constant care of official *súide*, acquired a completeness, fullness, and a certain degree of consistency which is wonderful. In the eleventh and twelfth centuries this legendary history was fitted with a chronology, and synchronized with the annals of historical nations.

With all their drawbacks, the Irish ethnic legends, when stripped of their elaborate details and Biblical and classical loans, express the broad facts of the peopling of Ireland, and are in accordance with the results of archæological investigation. At the earliest period the country was well wooded, and the interior full of marshes and lakes; it was occupied by a sparse population, who appear in later times as "forest tribes" (*Tuatha Feda*), and were, doubtless, of the aboriginal (Iberic) race of western and southern Europe. The story of Partholan represents the incoming of the first bronze-armed Celts, who were a Goidelic tribe akin to the later Scots that settled on the seacoast, and built the fortresses occupying the principal headlands. They formed, with the forest tribes, the basis of the population in the Early Bronze age. Afterward came the various tribes known by the general name of *Firbolgs*. It is not necessary to suppose that all the tribes included under this name came at the same time, or even that they were closely akin. The legend names several tribes, and tells us that they came into Ireland at different places from Britain. The effect of their immigrations now appear to have been that in the north the people were *Cruithni*, or Picts of the Goidelic branch of the Celts; in the east and center, British and Belgic tribes; and in Munster, when not distinctly Iberic, of a southern or Gaulish type.

The opening of the historic period was marked by a great struggle of tribes, which took place about the beginning of the Christian era, and of which Irish annalists have left us but very scanty information, and that confused and misleading. This struggle was brought about by the arrival from abroad of a new tribe, or the rise of an old one. The former view seems the more probable, for at that time great displacements of the Celts were taking place everywhere consequent on the conquests of the Romans, and some of the displaced tribes may have migrated to Ireland. The victors in the struggle appear afterward as Scots; the conquered tribes are called *Aithech Tuatha*, that is, vassal tribes, because they paid *daer* or base rent.

In the beginning of the fourth century there was an organized Christian church in Britain, for there were British bishops at the council of Arles in 314 A.D., one of whom was probably from Wales. At that time the Irish had possession of many places in west and south Britain, and must have come in contact with Christians. These were more numerous and the church better organized in south Wales and southwest Britain, where the Munster or southern Irish were, than in north Wales, held by the Scots proper. Christianity may have therefore found its way into Munster some time in the fourth century. There is a story of four bishops who, with several priests and anchorites, lived in Munster before the mission of St. Patrick, which was credited by such high authorities as Colgan and Ussher, but later inquiries have shown that most if not all these either were contemporaries of St. Patrick or belonged to a later time. But, although it is almost certain that no organized church existed in Ireland before the mission of St. Patrick, there may have been several scattered communities in the south of Ireland. According to Constantius of Lyons, the contemporary and biographer of Germanus, the British bishops, alarmed at the rapid

progress of Pelagianism in Britain, sought the aid of the Gaulish Church; a numerous synod summoned for the occasion commissioned Germanus and Lupus to go to Britain, which they accordingly did in 429, according to the usual reckoning. Prosper of Aquitaine on the other hand attributes the mission of Germanus to the pope, and makes no mention of the action of the Gaulish bishops; but he adds that it was done through the action of the deacon Palladius. There is nothing inconsistent in the two accounts, for the acts of the council were probably sent to the pope by a special messenger, who was Palladius. The latter was probably a Briton, but of the Gaulish family of the Palladii. Ammianus Marcellinus mentions a Palladius holding high office in Britain in the middle of the fourth century. Palladius was probably the envoy of the British bishops both to Gaul and to the pope. If he was a Briton, he would naturally have been anxious for the conversion of the Irish as the most effectual way of stopping the Scotie incursions, and was therefore a fitting person to be selected for such a mission. Our information about Palladius is derived from the various lives of St. Patrick, of which seven have been printed by Colgan.

The death of Palladius is assumed to have taken place in 431, and the mission of St. Patrick to have begun in the following year. Our knowledge of the Irish apostle is, however, so contradictory and unsatisfactory that no reliance can be placed on any dates connected with him. In any case, when we remember the time and the state of Europe, it is not at all likely that the place of Palladius could be so rapidly supplied as the above dates make out. While there are many lives of the saint, these are rather legendary than historical biographies (see PATRICK). But although there is much obscurity and confusion in the acts of St. Patrick, there cannot be the slightest doubt of his real existence. He was thoroughly acquainted with the people of Ireland, and consequently knew that he should secure the chief in order to succeed with the clan, and this is what he did. At first the conversion was only apparent, but, although the mass of the people still continued practically pagans, the apostle was enabled to found churches and schools, and educate a priesthood, and thus provide the most effective and certain means of converting the whole people. He was, undoubtedly, a great missionary, full of zeal, but withal prudent, and guided by much good sense. The learned Tillemont, judging Patrick by the writings attributed to him, truly says that he had much of the character of St. Paul, and was well read in Scripture.

The church founded by St. Patrick was identical in doctrine with the churches of Britain and Gaul, and other branches of the Western Church. There is no evidence that the Pelagian heresy found an entrance there, and least of all is there the slightest foundation for the supposition that it had any connection with the Eastern Church. Its organization was, however, peculiar; and, as countries in the tribal state of society are very tenacious of their customs, the Irish Church preserved these peculiarities for a long time, and carried them into other countries, by which the Irish were brought into direct collision with a different and more advanced church organization. Wherever the Roman law and municipal institutions had been in force, the church society was modeled on the civil one.

From the beginning the church of St. Patrick was monastic, as is proved by a passage in his *Confessio*, where, speaking of the success of his mission, he says: "The sons of Scots and daughters of chiefs appear now as monks and virgins of Christ, especially one blessed Scottish lady of noble birth and of great beauty who was adult, and whom I baptized." But the early Irish

monasticism was unlike that known at a later period. An Irish *cœnobium* of the earliest type was simply an ordinary sept or family whose chief had become Christian, and making a gift of his land either retired leaving it in the hands of a *comarba*, or remained as the religious head himself. The family went on with their usual avocations, but some of the men and women, and in some cases all, practiced celibacy, and all joined in fasting and prayer. These communities offer many striking analogies with the Shaker communities of the United States. A severer and more exclusive system of monasticism succeeded this primitive one, but its general character never entirely changed.

From the nature of the organization of the Irish Church as established by St. Patrick, it was to be expected that on his death the bond between the numerous church families which his great authority supplied would be greatly relaxed. The Druidic orders, too, which there is reason to believe remained still to a large extent pagan, and undoubtedly practiced many of their arts even in the seventh century, must have regained much of their old power. A tradition exists that at the instance of St. Patrick the laws were purified by a commission of which he himself was a member, and collected into a body called the *Senchas Mór*. Nevertheless the pagan marriage customs were practiced long after St. Patrick's time.

The encroachments of the Saxons which forced the Cymri of the north into Wales, and the consequent driving out of the Irish from their possessions in Wales and southwest Britain, and the desolation and anarchy of the whole country, appear to have caused many British ecclesiastics to seek a refuge in Ireland, among whom was Gildas, who is said to have been invited over by King Ainmire. But, whether as an invited guest or as a refugee, Gildas certainly helped to reform the Irish Church, at least of Leth Cuind, or Cond's Half. During this period the energy of the youth of Ireland seems to have concentrated itself on religious asceticism and missionary work. St. Columcille converted the Picts, and, from his monastery of Hí, went forth the illustrious Aidan to plant another Iona at Lindisfarne, which, as Mr. Hill Burton, the historian of Scotland, says, "long after the poor parent brotherhood had fallen to decay, expanded itself into the bishopric of Durham, or, as some will have it, the archbishopric of York itself; for, of all the Christian missions to England, that of Aidan seems to have taken the firmest root." This was also the period of the great missionaries of the Continent, Columbanus, Gall, Killian, and many others. Nor had the old daring on the sea, which distinguished the Scotie adventurers who had ravaged the coast of Britain, and which still characterizes the Celtic fishermen of the west of Scotland, the Isle of Man, Cornwall and Brittany, and the colony of Newfoundland, died out among the Gael of South Munster, for, besides St. Brendan, whose voyages have given rise to a widespread myth, there was another navigator, Cormac, a disciple of St. Columcille, who visited the Orkneys, and discovered the Faroe Islands and Iceland, long before the Northmen set foot on them. Other Irishmen, seeking remote places to lead there the lives of anchorites, followed in their tracks, and, when the Northmen first discovered Iceland, they found there books and other traces of the Irish of the early church.

The history of Ireland's connection with ENGLAND (*q.v.*) dates from the middle of the twelfth century.

Nicholas Breakspeare, known in history as Hadrian IV., was the only Englishman who ever filled the papal chair. He granted a bull to Henry II. in 1155 which contains this passage:—"There is no doubt, and your nobility acknowledges, that Ireland and all islands upon

which Christ the Sun of righteousness has shone, and which have received the teachings of the Christian faith, rightfully belong to the blessed Peter and the most holy Roman Church." Believing that Henry was likely to use his power for the good of religion and of the church, he granted Ireland to him, reserving all ecclesiastical rights, and making one penny from each house payable yearly to St. Peter.

In 1156 Dermot MacMurrough, deposed for his tyranny from the kingdom of Leinster, repaired to Henry in Aquitaine. The king was busy with the French, but gladly seized the opportunity of asserting his claim, and gave Dermot a letter authorizing him to raise forces in England. Thus armed, and provided with gold extorted from his former subjects in Leinster, Dermot went to Bristol and sought the acquaintance of Richard de Clare, a Norman noble of great ability but broken fortunes. Earl Richard, whom later usage has named Strongbow, agreed to reconquer Dermot's kingdom for him. The stipulated consideration was the hand of Eva, his only child, and according to feudal law his sole heir, to whose issue lands and kingdoms would naturally pass. But Irish customs admitted no estates of inheritance, and Eva had no more right to the reversion of Leinster than she had to that of Japan. It is likely that Strongbow had no conception of this, and that his first collision with the tribal system was an unpleasant surprise. Passing through Wales, Dermot agreed with Robert Fitzstephen and Maurice Fitzgerald to invade Ireland in the ensuing spring.

About May 1, 1169, Fitzstephen landed on the Wexford shore with a small force, and next day Maurice de Prendergast brought another band nearly to the same spot. Dermot joined them, and the Danes of Wexford soon submitted. According to agreement Dermot granted the territory of Wexford, which had never belonged to him, to Robert and Maurice and their heirs forever. And here begins the conflict between feudal and tribal law, which was destined to deluge Ireland in blood. Maurice Fitzgerald soon followed with a fresh detachment. About a year after the first landing Raymond Le Gros was sent over by Earl Richard with his advanced guard, and Strongbow himself landed near Waterford on August 23, 1170, with 200 knights and about 1,000 other troops.

The natives did not understand that this invasion was quite different from those of the Danes. They made alliances with the strangers to aid them in their intestine wars, and the annalist writing in later years (*Annals of Lough Cé*) describes with pathetic brevity the change wrought in Ireland: "Earl Strongbow came into Erin with Dermot MacMurrough to avenge his expulsion by Roderick, son of Turlough O'Connor; and Dermot gave him his own daughter and a part of his patrimony, and Saxon foreigners have been in Erin since then."

While waiting for Strongbow's arrival, Raymond and Hervey were attacked by the Waterford Danes, whom they overthrew. Seventy prisoners were thrown over a cliff into the sea. Strongbow himself took Waterford and Dublin, and the Danish inhabitants of both readily combined with their French-speaking kinsfolk, and became firm supporters of the Anglo-Normans against the native Irish.

Alarmed at the principality forming near him, Henry invaded Ireland in person, having first had Hadrian's grant confirmed by Alexander III., so as to gain the support of the Irish clergy. He landed near Waterford October 18, 1172. Giraldus says he had 500 knights and many other soldiers; Regan, the metrical chronicler, says he had 4,000 men, of whom 400 were knights; the *Annals of Lough Cé* that he had 240 ships. The Irish writers tell little about these great events, except

that the king of the Saxons took the hostages of Munster at Waterford, and of Leinster, Ulster, Thomond, and Meath at Dublin. They did not take in the grave significance of doing homage to a Norman king, and becoming his "man."

The mail-clad knights were not uniformly successful against the natives, but they generally managed to occupy the open plains and fertile valleys. Geographical configuration preserved centers of resistance—the O'Neills in Tyrone and Armagh, the O'Donnells in Donegal, and the Macarthies in Cork being the largest tribes that remained practically unbroken. On the coast from Bray to Dundalk, and by the navigable rivers of the east and south coasts, the Norman put his iron foot firmly down.

Henry granted Meath, about 800,000 acres, to Hugo de Lacy, reserving scarcely any prerogative to the crown, and making his vassal almost independent.

There is a vague tradition that Edward I. visited Ireland about 1256, when his father ordained that the prince's seal should have regal authority in that country. A vast number of documents remain to prove that he did not neglect Irish business. Yet this great king cannot be credited with any specially enlightened views as to Ireland.

Outwardly all seemed fair. The De Burghs were supreme in Connaught, and English families occupied eastern Ulster. The fertile southern and central lands were dominated by strong castles. But Tyrone and Tyrconnel, and the mountains everywhere, sheltered the Celtic race, which, having reached its lowest point under Edward I., began to recover under his son.

In 1315, the year after Bannockburn, Edward Bruce landed near Larne with 6,000 men, including some of the best knights in Scotland. Supported by O'Neill and other chiefs, and for a time assisted by his famous brother, Bruce gained many victories. The Scots ranged at will over great part of Ireland, but the brothers never took Dublin, though they came as near it as Castleknock. There was no general effort of the natives in their favor; perhaps the Irish thought one Norman no better than another, and their total incapacity for national organization forbade the idea of a native sovereign. The family quarrels of the O'Connors at this time, and their alliances with the Burkes, or De Burghs, and the Birminghams, may be traced in great detail in the annals—the general result being fatal to the royal tribe of Connaught, which is said to have lost 10,000 warriors in the battle of Templetoher. In other places the English were less successful, the Butlers being beaten by the O'Carrolls in 1318, and Richard de Clare falling about the same time in the decisive battle of Dysert O'Dea. The O'Briens reestablished their sway in Thomond, and the illustrious name of De Clare disappears from Irish history. Edward Bruce fell in battle near Dundalk, most of his army recrossing the channel, and leaving behind a reputation for cruelty and rapacity. Indeed, the invaders were generally hated, and have had little thanks either from Irish or colonial chroniclers. The colonists were victorious, but their organization was undermined, and the authority of the crown, which had never been able to keep the peace, grew rapidly weaker. Within twenty years after the great victory of Dundalk, the quarrels of the barons allowed the Irish to recover much of the land they had lost.

The brilliant reign of Henry V. was a time of extreme misery to the colony in Ireland. Half the English-speaking people fled to England, where they were not welcome.

The disastrous reign of the third Lancastrian completed the discomfiture of the original colony in Ireland. Quarrels between the Ormonde and Talbot parties

paralyzed the government, and a "Pale" of thirty miles by twenty was all that remained. Even the walled towns, Kilkenny, Ross, Wexford, Kinsale, Youghal, Clonmel, Kilmallock, Thomastown, Fethard, and Cashel were almost starved out; Waterford itself was half ruined and half deserted. Only one parliament was held for thirty years, but taxation was not remitted on that account. No viceroy even pretended to reside continuously. The north and west were still worse off than the south.

Occupied in pleasure or foreign enterprise, Henry VIII. at first paid little attention to Ireland. The royal power was practically confined to what in the previous century had become known as the "Pale," that is, Dublin, Louth, Kildare, and a part of Meath, and within this narrow limit the earls of Kildare were really more powerful than the crown. Waterford, Drogheda, Dundalk, Cork, Limerick, and Galway were not Irish, but rather free cities than an integral part of the kingdom; and many inland towns were in the same position. The house of Ormonde had created a sort of small Pale about Kilkenny, and part of Wexford had been colonized by men of English race. The Desmonds were Irish in all but pride of blood. The Barretts, Condons, Courcies, Savages, Arundels, Carews, and others had disappeared or merged in the Celtic mass. Anglo-Norman nobles became chiefs of pseudo-tribes, which acknowledged only the Brehon law, and paid dues and services in kind. These pseudo-tribes were often called "nations," and a vast number of exactions were practiced by the chiefs. "Coyne and livery"—the right of free quarters for man and beast—arose among the Anglo-Normans, and became more oppressive than any native custom. When Henry took to business, he laid the foundation of reconquest. The house of Kildare, which had actually besieged Dublin (1534), was overthrown, and the Pale saved from a standing danger. But the Pale scarcely extended twenty miles from Dublin, a March of uncertain width intervening between it and the Irish districts. Elsewhere, says an elaborate report, all the English folk were of "Irish language and Irish condition," except in the cities and walled towns. Down and Louth paid black rent to O'Neill, Meath and Kildare to O'Connor, Wexford to the Kavanaghs, Kilkenny and Tipperary to O'Carroll, Limerick to the O'Briens, and Cork to the McCarthies. McMurrough Kavanagh, in Irish eyes the representative of king Dermot, received an annual pension from the exchequer. Henry set steadily to work to reassert the royal title. He assumed the style of king of Ireland, so as to get rid of the notion that he held the island of the pope. The Irish chiefs acknowledged his authority and his ecclesiastical supremacy, abjuring at the same time that of the Holy See. The lands of the earl of Shrewsbury and other absentees, who had performed no duties, were resumed; and both Celtic and feudal nobles were encouraged to come to court. Here begins the long line of official deputies, often men of moderate birth and fortune. Butler and Geraldine, O'Neill and O'Donnell, continued to spill each other's blood, but the feudal and tribal systems were alike doomed. In the names of these Tudor deputies and other officers we see the origin of many great Irish families—Skeffington, Brabazon, St. Leger, Fitzwilliam, Wingfield, Bellingham, Carew, Bingham, Loftus, and others. Nor were the Celts overlooked. O'Neill and O'Brien went to London to be invested as earls of Tyrone and Thomond respectively. O'Donnell, whose descendants became earls of Tyrconnel, went to court and was well received. The pseudo-chief McWilliam became earl of Clanricarde, and others reached lower steps in the peerage, or were knighted by the king's own hand. All were encouraged

to look to the crown for redress of grievances, and thus the old order slowly gave place to the new.

The moment when Protestantism and Ultramontanism are about to begin their still unfinished struggle is a fit time to notice the chief points in Irish church history. Less than two years before Strongbow's arrival Pope Eugenius had established an ecclesiastical constitution in Ireland depending on Rome, but the annexation was very imperfectly carried out, and the hope of fully asserting the Petrine claims was a main cause of Hadrian's gift to Henry II. It is a reproach to England that after four centuries Ireland was still without a university. Attempts to found one at Dublin (1311) or Drogheda (1465) failed for want of funds. The work was partially done by the great abbeys, boys of good family being brought up by the Cistercians of Dublin and Jerpoint, and by the Augustinians of Dublin, Kells, and Conall, and girls by the canonesses of Gracedieu. A strong effort was made to save these six houses, but Henry VIII. would not hear of it, and there was no Irish Wolsey partially to supply the king's omissions.

Ample evidence exists that the Irish Church was full of abuses before the movement under Henry VIII. We have detailed accounts of three sees—Clonmacnoise, Enaghduane, and Ardagh. Ross, also in a wild district, was in rather better case. But even in Dublin strange things happened; thus the archiepiscopal crozier was in pawn for eighty years from 1449. The morals of the clergy were no better than in other countries, and we have evidence of many scandalous irregularities. Where his hand reached Henry had little difficulty in suppressing the monasteries or taking their lands, which Irish chiefs swallowed as greedily as men of English blood. But the friars, though pretty generally turned out of doors, were themselves beyond Henry's power, and continued to preach everywhere among the people. Their devotion and energy may be freely admitted; but the mendicant orders, especially the Carmelites, were not uniformly distinguished for morality. Monasticism was momentarily suppressed under Oliver Cromwell; but the Restoration brought them back to their old haunts. The Jesuits, placed by Paul III. under the protection of Con O'Neill, "prince of the Irish of Ulster," came to Ireland toward the end of Henry's reign, and helped to keep alive the Roman tradition. It is not surprising that Anglicanism—the gospel light that dawned from Boleyn's eyes—recommended by such prelates as Browne and Bale, should have been regarded as a symbol of conquest and intrusion. The Four Masters thus describe the Reformation:—"A heresy and new error arising in England, through pride, vainglory, avarice, and lust, and through many strange sciences, so that the men of England went into opposition to the pope and to Rome." The destruction of relics and images and the establishment of a schismatic hierarchy is thus recorded:—"Though great was the persecution of the Roman emperors against the church, scarcely had there ever come so great a persecution from Rome as this." Such was Roman Catholic opinion in Ireland in the sixteenth century, and such it is still. In vulgar Irish the word "Sassenagh" denotes a Protestant as well as an Englishman.

The English Government long hesitated about the official establishment of Protestantism, and the royal order to that effect was withheld until 1551. Copies of the new liturgy were sent over, and St. Leger had the communion service translated into Latin, for the use of priests and others who could read, but not in English. The popular feeling was strong against innovation. The Reformation having made no real progress, Mary found it easy to restore the old ways. Dowdall was restored; Browne, Staples, and others were deprived.

Bale fled for bare life, and his see was treated as vacant. Yet the queen found it impossible to restore the monastic lands, though she showed some disposition to scrutinize titles of grantees. She was Tudor enough to declare her intention of maintaining the old prerogatives of the crown against the Holy See, and assumed the royal title without papal sanction. Paul IV. was fain to curb his fiery temper, and to confer graciously what he could not withhold. English Protestants fled to Ireland to escape the Marian persecution; but respectable evidence exists to show that, had the reign continued a little longer, Dublin would have been no safe place of refuge.

Mary scarcely varied the civil policy of her brother's ministers. Gerald of Kildare was restored to his earldom. The plan of settling Leix and Offaly by dividing the country between colonists and natives holding by English tenure failed, owing to the unconquerable love of the people for their own customs. But resistance gradually grew fainter, and we hear little of the O'Connors after this. The O'Mores, reduced almost to brigandage, gave trouble till the end of Elizabeth's reign, and a member of the clan was chief contriver of the rebellion of 1641. Maryborough and Philipstown, King's county and Queen's county, commemorate Mary's ill-starred marriage.

Anne Boleyn's daughter succeeded quietly, and Sir Henry Sidney was sworn lord-justice with the full Catholic ritual. When Sussex superseded him as lord-lieutenant, the litany was chanted in English, both cathedrals having been painted, and Scripture texts substituted for "pictures and popish fancies." At the beginning of 1560 a parliament was held which restored the ecclesiastical legislation of Henry and Edward. In two important points the Irish Church was made more dependent on the state than in England: *congrégations d'élire* were abolished, and heretics made amenable to royal commissioners or to parliament without reference to any synod or convocation. According to a contemporary list, this parliament consisted of three archbishops, seventeen bishops, twenty-three temporal peers, and members returned by ten counties and twenty-eight cities and boroughs. We know not whether all were present, and therefore the list throws no light on the dispute as to the conformity of Irish bishops in possession at Elizabeth's accession. A careful scrutiny shows that Curwen of Dublin and O'Fihily of Leighlin actually conformed. Bodkin of Tuam, De Burgh of Clonfert, and perhaps some others took the oath of supremacy; but the English convocation under Henry VIII. had done no less, and it involved no doctrinal changes. Walsh of Meath, Leverous of Kildare, and probably Thonory of Ossory, were deprived. In other cases Elizabeth connived at what she could not prevent, and hardly pretended to enforce uniformity except in the Pale and in the large towns.

Ulster demanded the immediate attention of Elizabeth. Shane O'Neill maintained a contest, which had begun under Mary, until 1567, with great ability and a total absence of morality, in which Sussex had no advantage over him. The lord-lieutenant twice tried to have Shane murdered; once he proposed to break his safe-conduct; and he held out hopes of his sister's hand as a snare. Shane was induced to visit London, where his strange appearance and followers caused much amusement, and where he spent his time intriguing with the Spanish ambassador and making himself agreeable to Lord Robert Dudley. The government detained him rather unfairly, and the young baron of Dungannon suffered his father's fate, leaving a brother who at last gained the coveted earldom, and became a more dangerous enemy to England than ever Shane had been.

Sussex was outmatched both in war and diplomacy; the loyal chiefs were crushed one by one; and the English suffered checks of which the moral effect was ruinous. Shane always fully acknowledged Elizabeth as his sovereign, and sometimes played the part of a loyal subject, wreaking his private vengeance under color of expelling the Scots from Ulster. At last, in 1566, the queen placed the sword of state in Sidney's strong grasp. Shane was driven helplessly from point to point, and perished miserably at the hands of the McDonnells, whom he had so often oppressed and insulted.

Peace was soon broken by disturbances in the south. The earl of Desmond having shown rebellious tendencies was detained for six years in London. Treated leniently, but grievously pressed for money, he tried to escape, and, the attempt being judged treasonable, he was persuaded to surrender his estates—to receive them back or not at the queen's discretion. Seizing the opportunity, English adventurers proposed to plant a military colony in the western half of Munster, holding the coast from the Shannon to Cork harbor. Some who held obsolete title deeds were encouraged to go to work at once by the example of Sir Peter Carew, who had established his claims in Carlow. Carew's title had been in abeyance for a century and a half, yet most of the Kavanaghs attorned to him. Falling foul of Ormonde's brothers, seizing their property and using great cruelty and violence, Sir Peter drove the Butlers, the only one among the great families really loyal, into rebellion. Ormonde, who was in London, could alone restore peace; all his disputes with Desmond were at once settled in his favor, and he was even allowed to resume the exaction of coyne and livery, the abolition of which had been the darling wish of statesmen. The Butlers returned to their allegiance, but continued to oppose Carew, and great atrocities were committed on both sides. Sir Peter had great but undefined claims in Munster also, and the people there took warning. His imitators in Cork were swept away. Sidney first, and after him Humphrey Gilbert, could only circumscribe the rebellion. Toward the end of 1575 Sidney was again persuaded to become viceroy. The Irish recognized his great qualities, and he went everywhere without interruption. Henceforth presidencies became permanent institutions. Drury in Munster hanged four hundred persons in one year, Malby in reducing the Connaught Burkes spared neither young nor old, and burned all corn and houses. The Desmonds determined on a great effort. A holy war was declared. Fitzmaurice landed in Kerry with a few followers, and accompanied by the famous Nicholas Sanders, who was armed with a legate's commission and a banner blessed by the pope. Fitzmaurice fell soon after in an encounter with Malby, but Sanders and Desmond's brothers still kept the field. When it was too late to act with effect, Desmond himself, a vain man, neither frankly loyal nor a bold rebel, took the field. He surprised Youghal, then an English town, by night, sacked it, and murdered the people. Roused at last, Elizabeth sent over Ormonde as general of Munster, and after long delay gave him the means of conducting a campaign. "I will merely," wrote Burghley, "say Butler Aboo against all that cry in a new language Papa Aboo." It was in fact as much a war of Butlers against Geraldines as of loyal subjects against rebels, and Ormonde did his work only too well. Lord Baltinglass raised a hopeless subsidiary revolt in Wicklow (1580), which was signalized by a crushing defeat of Lord-Deputy Grey (Arthegal) in Glenmalure. A force of Italians and Spaniards landing at Smerwick in Kerry, Grey hurried thither, and the foreigners, who had no commission,

surrendered at discretion, and were put to the sword. Neither Grey nor the Spanish ambassador seems to have seen anything extraordinary in thus disposing of inconvenient prisoners. Spenser and Raleigh were present. Sanders perished obscurely in 1581, and in 1583 Desmond himself was hunted down and killed in the Kerry mountains. More than 500,000 Irish acres were forfeited to the crown. The horrors of this war it is impossible to exaggerate. The Four Masters say that the lowing of a cow or the voice of a plowman could scarcely be heard from Cashel to the furthest point of Kerry; Ormonde, who, with all his severity, was honorably distinguished by good faith, claimed to have killed 5,000 men in a few months. Spenser, an eye-witness, says famine slew far more than the sword.

In 1584 Hugh O'Neill, if O'Neill he was, became chief of part of Tyrone; in 1587 he obtained the coveted earldom, and in 1593 was the admitted head of the whole tribe. A quarrel with the government was inevitable, and, Hugh Roe O'Donnell having joined him, Ulster was united against the crown. In 1598 James Fitzthomas Fitzgerald assumed the title of Desmond, to which he had some claims by blood, and which he pretended to hold as Tyrone's gift. Tyrone had received a crown of peacock's feathers from the pope, who was regarded by many as king of Ireland. The title of *Sugan* or straw-rope earl has been generally given to the Desmond pretender. Both ends of the island were soon in a blaze, and the Four Masters say that in seventeen days there was not one son of a Saxon left alive in the Desmond territories. Edmund Spenser lost his all, escaping only to die of misery in a London garret. Tyrone more than held his own in the north, completely defeated Sir H. Bagenal in the battle of the Yellow Ford (1598), invaded Munster, and ravaged the lands of Lord Barrymore, who had remained true to his allegiance. Tyrone's ally, Hugh Roe O'Donnell, overthrew the president of Connaught. "The Irish of Connaught," say the Four Masters, "were not pleased at Clifford's death; * * he had never told them a falsehood." Essex came over in 1599 with a great army, but did nothing of moment, was outgeneraled and outwitted by Tyrone, and threw up his command to enter on the mad and criminal career which led to the scaffold. In 1600 Sir George Carew became president of Munster, and, as always happens when the crown was well served, the rebellion was quickly put down. Mountjoy, who succeeded Essex, joined Carew, and a Spanish force which landed at Kinsale surrendered. The destruction of their crops starved the people into submission, and the contest was only less terrible than the first Desmond war because it was much shorter. In Ulster Mountjoy was assisted by Sir Henry Docwra, who founded the second settlement at Derry, the first under Randolph having been abandoned. Hugh O'Donnell sought help in Spain, where he died. Tyrone submitted at last, craving pardon on his knees, renouncing his Celtic chieftainry, and abjuring all foreign powers, but still retaining his earldom, and power almost too great for a subject.

Great things were expected of James I. He was Mary Stuart's son, and there was a curious antiquarian notion afloat that, because the Irish were the original "Scoti," a Scottish king would sympathize with Ireland. Corporate towns set up the mass, and Mountjoy, who could argue as well as fight, had to teach them a sharp lesson. Finding Ireland conquered and in no condition to rise again, James established circuits and a complete system of shires. Sir John Davies was sent over as solicitor-general. The famous book in which he glorifies his own and the king's exploits gives far too much credit to the latter, and far too little to his great

predecessor. When she was still alive to confer favors, Davies in very creditable verse had lavished praises upon Elizabeth which must have seemed exaggerated even to her.

Two legal decisions swept away the customs of tanystry and of Irish gavelkind, and the English land system was violently substituted. Tyrone was harassed by sheriffs and other officers, and the government, learning that he was engaged in an insurrectionary design, prepared to seize him. Tyrone, Donegal, Armagh, Cavan, Fermanagh, and Derry were parceled out among English and Scotch colonists, portions being reserved to the natives. The site of Derry was granted to the citizens of London, who fortified and armed it, and Londonderry became the chief bulwark of the colonists in two great wars.

It may be convenient to notice here the parliamentary history of the English colony in Ireland, which corresponds pretty closely with that of the mother country. First there are informal meetings of eminent persons; then, in 1295, there is a parliament, of which some acts remain, and to which only knights of the shire were summoned to represent the commons. Burgesses were added as early as 1310. The famous parliament of Kilkenny in 1367 was largely attended, but the details of its composition are not known. The most ancient Irish parliament remaining on record was held in 1374, twenty members in all being summoned to the House of Commons, from the Counties of Dublin, Louth, Kildare, and Carlow, the liberties and crosses of Meath, the City of Dublin, and the towns of Drogheda and Dundalk. Elizabeth's first parliament, held in 1559, was attended by 76 members of the lower house, which increased to 122 in 1585. In 1613 James I. by a wholesale creation of new boroughs, generally of the last insignificance, increased the House of Commons to 232, and thus secured an Anglican majority to carry out his policy. He told those who remonstrated to mind their own business. In 1639 the House of Commons had 274 members, a number which was further increased to 300 at the Revolution, and so it remained until the Union.

The necessities of Charles I. induced his ministers to propose that a great part of Connaught should be declared forfeited, owing to mere technical flaws in title, and planted like Ulster. Such was the general outcry that the scheme had to be given up; and, on receiving a large grant from the Irish parliament, the king promised certain graces, of which the chief were security for titles, a free trade, and the substitution of an oath of allegiance for that of supremacy. Having got the money, Charles as usual broke his word; and in 1635 Lord Deputy Strafford began a general system of extortion. The Connaught and Munster landowners were shamelessly forced to pay large fines for the confirmation of even recent titles. The Irish woolen manufacture was discouraged as hurtful to England; and, if linen was encouraged, it was only because no linen was made in the greater kingdom. The money obtained by oppressing the Irish nation was employed to create an army for the oppression of the Scotch and English nations. The Catholic insurgents of 1641 just failed to seize Dublin, but quickly became masters of nearly the whole country. That there was no definite design of massacring the Protestants is likely, but it was intended to turn them out. Great numbers were killed, often in cold blood and with circumstances of great barbarity. The English under Coote and others retaliated. In 1642 a Scottish army under Monro landed in Ulster, and formed a rallying point for the colonists. Londonderry, Enniskillen, Coleraine, Carrickfergus, and some other places defied Sir Phelim O'Neill's tumultuary host.

Trained in foreign wars, Owen Roe O'Neill gradually formed a powerful army among the Ulster Irish, and it is impossible to overestimate his skill and patience. But like other O'Neills, he did little out of Ulster, and his great victory over Monro (1645) had no lasting results. The old English of the Pale were forced into rebellion, but could never get on with the native Irish, who hated them only less than the new colonists. Ormonde throughout maintained the position of a loyal subject, and, as the king's representative, played a great but hopeless part. The Celts cared nothing for the king except as a weapon against the Protestants; the old Anglo-Irish Catholics cared much, but the nearer Charles approached them the more completely he alienated the Protestants.

In all their negotiations with Ormonde and Glamorgan, Henrietta Maria and Digby, the pope and Rinuccini stood out for an arrangement which would have destroyed the royal supremacy and established Romanism in Ireland, leaving to the Anglicans bare toleration, and to the Presbyterians not even that. Charles behaved after his kind, showing, not only his falseness, but also his total want of real dignity. Ormonde was forced to surrender Dublin to the Parliamentarians (1646), and the inextricable knot awaited Cromwell's sword. The total inability of the Irish Catholics to form anything like a working government during their nine years of power proves that her history, and the discordant ingredients of her population, must ever prevent Ireland from achieving a separate political existence.

Cromwell's campaign (1649-50) showed how easily a good general with an efficient army might conquer Ireland. Resistance in the field was soon at an end; the starving-out policy of Carew and Mountjoy was employed against the guerrillas, and the soldiers were furnished with scythes to cut down the green corn. Bibles were also regularly served out to them. Oliver's severe conduct at Drogheda and elsewhere is not morally defensible, but much may be urged in his favor. Strict discipline was maintained—he hanged soldiers for stealing chickens; faith was always kept; and short, sharp action was more merciful in the long run than a milder but less effective policy. The character and designs of this great man offer a most difficult problem. For a time Lord Clarendon had it all his own way; in due course came a reaction so violent that the Protector has been almost deified in some quarters. Ireton was in many respects a copy of his father-in-law. Cromwell's civil policy, to use Macaulay's words, was "able, straightforward and cruel." He thinned the disaffected population by allowing foreign enlistment, and 40,000 are said to have been thus got rid of. Already Irish Catholics of good family had learned to offer their swords to foreign princes. In Spain, France and the empire they often rose to the distinction which they were denied at home. About 9,000 persons were sent to the West Indies, practically into slavery. Thus, and by the long war, the population was reduced to some 850,000, of whom 150,000 were English and Scots; the marvel is that so many were left. Then came the transplantation beyond the Shannon. The Irish Catholic gentry were removed bodily with their servants and such tenants as consented to follow them, and with what remained of their cattle. They suffered dreadful hardships. To exclude foreign influences, a belt of one mile was reserved to soldiers on the coast from Sligo to the Shannon, but the idea was not fully carried out. The derelict property in the other provinces was divided between adventurers who had advanced money and soldiers who had fought in Ireland. Many of the latter sold their claims to officers or speculators, who

were thus enabled to form estates. The majority of Irish laborers stayed to work under the settlers, and the country became peaceful and prosperous. Some fighting Catholics haunted woods and hills under the name of Tories, afterward given in derision to a great party, and were hunted down with as little compunction as the wolves to which they were compared. Measures of great severity were taken against Catholic priests; but it is said that Cromwell had great numbers in his pay, and that they kept him well informed. All classes of Protestants were tolerated, and Jeremy Taylor preached unmolested. Commercial equality being given to Ireland, the woolen trade at once revived, and a shipping interest sprang up. Were it worth while to prove Cromwell a greater statesman than Strafford, his religious and commercial policy in Ireland would supply ample evidence. A legislative union was also effected, and Irish members attended at Westminster.

Charles II. was bound in honor to do something for such Irish Catholics as were innocent of the massacres of 1641, and the claims were not scrutinized too severely. It was found impossible to displace the Cromwellians, but they were shorn of about one-third of their lands. When the Caroline settlement was complete it was found that the great rebellion had resulted in reducing the Catholic share of the fertile parts of Ireland from two-thirds to one-third. Ormonde, whose wife had been allowed by Cromwell's clemency to make him some remittances from the wreck of his estate, was largely and deservedly rewarded. A revenue of £30,000 was settled on the king, in consideration of which Ireland was in 1663 excluded from the benefit of the Navigation Act, and her nascent shipping interest ruined. In 1666 the importation of Irish cattle and horses into England was forbidden, the value of the former at once falling five-fold, of the latter twenty-fold. In 1687 the church of England discovered that there were limits to passive obedience, and at the close of the following year James was a fugitive in France. By this time Londonderry and Enniskillen had closed their gates, and the final struggle had begun. In March, 1689, James reached Ireland with some French troops, and summoned a parliament which repealed the Act of Settlement. The estates of absentees were vested in the crown, and, as only two months law was given, this was nearly equivalent to confiscating the property of all Protestants. Between 2,000 and 3,000 Protestants were attainted by name, and moreover, the act was not published. The dispossessed Protestants escaped by sea or flocked into Ulster, where a gallant stand was made. The glories of Londonderry and Enniskillen will live as long as the English language. The Irish cause produced one great achievement—the defense of Limerick, and one great leader—Patrick Sarsfield. The Catholic Celts, aided by France, were entirely beaten, the Protestant colonists, aided by England, were entirely victorious (battle of the Boyne, July 1, 1690; battle of Aughrim, July 12, 1691). Even the siege of Limerick showed the irreconcilable divisions which had nullified the efforts of 1641. Hugh Baldearg O'Donnell, last of Irish chiefs, sold his services to William for £500 a year. But it was their king that condemned the Irish to hopeless failure. He called them cowards, whereas the cowardice was really his own, and he deserted them in their utmost need. They repaid him with the opprobrious nickname of "Sheemas-a-Cacagh," or Dirty James.

Irish rhetoric commonly styles Limerick "the city of the violated treaty." The articles of capitulation (October 3, 1691) may be read in Leland or Plowden; from the first their interpretation was disputed. Hopes of religious liberty were held out, but were not fulfilled.

Lords Justices Porter and Coningsby promised to do their utmost to obtain a parliamentary ratification, but the Irish parliament would not be persuaded. There was a paragraph in the original draft which would have protected the property of the great majority of Catholics, but this was left out in the articles actually signed. William thought the omission accidental, but this is hardly possible. At all events he ratified the treaty in the sense most favorable to the Catholics, while the Irish parliament adhered to the letter of the document. Perhaps no breach of faith was intended, but the sorrowful fact remains that the modern settlement of Ireland has the appearance of resting on a broken promise. More than 1,000,000 Irish acres were forfeited, and, though some part was returned to Catholic owners, the Catholic interest in the land was further diminished.

From the first the victorious colonists determined to make another 1641 impossible, and the English Government failed to moderate their severity (principal Penal Act, 2 Anne, c. 3). In 1708 Swift declared that the Papists were politically as inconsiderable as the women and children. In despair of effecting anything at home, the young and strong enlisted in foreign armies, and the almost incredible number of 450,000 are said to have emigrated for this purpose between 1691 and 1745. This and the hatred felt toward James II. prevented any rising in 1715 or 1745. The panic-stricken severity of minorities is proverbial, but it is not to be forgotten that the Irish Protestants had been turned out of house and home twice within fifty years. In 1703 the Irish parliament begged hard for a legislative union, but as that would have involved at least partial free trade the English monopolists prevented it. By Poyning's law England had a vote on all Irish legislation, and was therefore an accomplice in the penal laws. No Papist might teach a school or any child but his own, or send children abroad—the burden of proof lying on the accused, and the decision being left to magistrates without a jury. Mixed marriages were forbidden between persons of property, and the children might be forcibly brought up Protestants. A Papist could not be a guardian and all wards in chancery were brought up Protestants. The Protestant eldest son of a landed proprietor might make his father tenant for life and secure his own inheritance. Among Papist children land went in compulsory gavelkind. Papists could not take longer leases than thirty-one years at two-thirds of a rack rent; they were even required to conform within six months of an inheritance accruing, on pain of being ousted by the next Protestant heir. Priests from abroad were banished, and their return declared treason. All priests were required to register and to remain in their own parishes, and informers were to be rewarded at the expense of the Papist inhabitants. No Papist was allowed arms, two justices being empowered to search; and if he had a good horse any Protestant might claim it on tendering £5. These laws were of course systematically evaded. The property of Roman Catholics was often preserved through Protestant trustees, and it is understood that faith was generally kept.

The restraints placed by English commercial jealousy on Irish trade destroyed manufacturing industry in the south and west. Driven by the Caroline legislation against cattle into breeding sheep, Irish graziers produced the best wool in Europe. Forbidden to export it, or to work it up profitably at home, they took to smuggling, for which the indented coast gave great facilities. The enormous profits of the contraband trade with France enabled Ireland to purchase English goods to an extent greater than her whole lawful traffic. The moral effect was disastrous. The religious penal code it was

thought meritorious to evade; the commercial penal code was ostentatiously defied; and both tended to make Ireland the least law-abiding country in Europe.

When William III. proceeded to depress the Irish woolen trade, he promised to do all he could for Irish linen. England did not fulfill the second promise; still the Ulster weavers were not crushed, and their industry flourished. Some Huguenot refugees, headed by Louis Crommelin, were established by William III. at Lisburn, and founded the manufacturing prosperity of Ulster. Other Huguenots attempted other industries, but commercial restraints brought them to nought. The peculiar character of the flax business has prevented it from crossing the mountains which bound the northern province. Wool was the natural staple of the south.

The Scottish Presbyterians who defended Londonderry were treated little better than the Irish Catholics who besieged it—the sacramental test of 1704 being the work of the English council rather than of the Irish parliament. In 1715 the Irish House of Commons resolved that anyone who should prosecute a Presbyterian for accepting a commission in the army without taking the test was an enemy to the king and to the Protestant interest. Acts of indemnity were regularly passed throughout the reign of George II., and until 1780, when the Test Act was repealed. A bare toleration had been granted in 1720. Various abuses, especially forced labor on roads which were often private jobs, caused the Oakboy insurrection in 1764. Eight years later the Steelboys rose against the exactions of absentee landlords, who often turned out Protestant yeomen to get a higher rent from Roman Catholic cotters. The dispossessed men carried to America an undying hatred of England which had much to say in the American revolution, and that again reacted on Ireland. Lawless Protestant associations, called Peep o' Day Boys, terrorized the north and were the progenitors of the Orangemen (1789). Out of the rival "defenders" Ribbonism in part sprung. The United Irishmen drew from both sources (1791).

But the Ulster peasants were never as badly off as those of the south and west. Writers the most unlike each other—Swift and Boulter, Berkeley and Stone, Arthur Young and Dr. Thomas Campbell—all tell the same tale. Toward the end of the seventeenth century Raleigh's fatal gift had already become the food of the people. When Chief Baron Rice went to London in 1688 to urge the Catholic claims on James II., the hostile populace escorted him in mock state with potatoes stuck on poles. Had manufactures been given fair play in Ireland, population might have preserved some relation to capital. As it was, land became almost the only property, and the necessity of producing wool for smuggling kept the country in grass. The poor squatted where they could, receiving starvation wages, and paying exorbitant rents for their cabins, partly with their own labor. Unable to rise, the wretched people multiplied on their potato plots with perfect recklessness. During the famine which began in the winter of 1739 one-fifth of the population is supposed to have perished; yet it is hardly noticed in literature, and seems not to have touched the conscience of that English public which in 1755 subscribed £100,000 for the sufferers by the Lisbon earthquake. As might be expected where men were allowed to smuggle and forbidden to work, redress was sought in illegal combinations and secret societies. The dreaded name of Whiteboy was first heard in 1761, and agrarian crime has never since been long absent. Since the Union we have had the Threshers, the Terry Alts, the Molly Maguires, the Rockites, and many others. Poverty has been the

real cause of all these disturbances, which were often aggravated by the existence of factions profoundly indicative of barbarism. Communism, cupidity, scoundrelism of all kinds have contributed to every disturbance. The tendency shown to screen the worst criminals is sometimes the result of sympathy, but more often of fear. The cruelties which have generally accompanied Whiteboyism is common to servile insurrections all over the world. No wonder if Irish landlords were formerly tyrannical, for they were in the position of slave-owners. The steady application of modern principles, by extending legal protection to all, has altered the slavish character of the oppressed Irish. The cruelty has not quite died out, but it is much rarer than formerly; and generally speaking, the worst agrarianism has of late years been seen in the districts which retain most of the old features.

The volunteers extorted partial free trade (1779), but manufacturing traditions had perished, and common experience shows how hard these are to recover. The demand for union was succeeded by a craving for independence. Poyning's law was repealed, and in 1782, in Mr. Grattan's opinion, Ireland was at last a nation. The ensuing period of eighteen years is the best known in Irish history. The quarrel and reconciliation of Flood and Grattan, the kindly patriotism of Charlemont, the eloquence, the devotion, the corruption, are household words. In 1784 out of 300 members eighty-two formed the regular opposition, of whom thirty were the nominees of Whig potentates and fifty-two were really elected. The majority contained twenty-nine members considered independent, forty-four who expected to be bought, forty-four placemen, twelve sitting for regular government boroughs, and twelve who were supposed to support the government on public grounds. The remaining seats were proprietary, and were let to government for valuable consideration. The House of Lords, composed largely of boroughmongers and controlled by political bishops, was even less independent. Only Protestant freeholders had votes, which encouraged leases for lives, about the worst kind of tenure, and the object of each proprietor was to control as many votes as possible. The necessity of finding Protestants checked subdivision for a time, but in 1793 the Roman Catholics received the franchise, and it became usual to make leases in common, so that each lessee should have a freehold interest of forty shillings. The landlord indeed had little choice, for his importance depended on the poll-book. Salaries, sinecures, even commissions in the army were reserved for those who contributed to the return of some local magnate.

But no political cause swelled the population as much as the potato. Introduced by Raleigh in 1610, the cultivation of this dangerous tuber developed with extraordinary rapidity. The Elizabethan wars were most injurious to industry, for men will not sow unless they hope to reap, and the very essence of military policy had been to deprive a recalcitrant people of the means of living. The Mantuan peasant was grieved at the notion of his harvest being gathered by barbarian soldiers, and the Irishman could not be better pleased to see his destroyed. There was no security for anyone, and everyone was tempted to live from hand to mouth. The decade of anarchy which followed 1641 stimulated this tendency fearfully. The labor of one man could plant potatoes enough to feed forty, and they could neither be destroyed nor carried away easily. When Petty wrote, early in Charles II.'s reign, this demoralizing esculent was already the national food. Potatoes cannot be kept very long, but there was no attempt to keep them at all; they were left in the ground, and dug as required. A frost which penetrated deep caused the

famine of 1739. Even with the modern system of storing in pits the potato does not last through the summer, and the "meal months"—June, July and August—always brought great hardship. The danger increased as the growing population pressed ever harder upon the available land. Between 1831 and 1842 there were six seasons of dearth, approaching in some places to famine.

The population increased from 2,845,932 in 1785 to 5,356,594 in 1803. They married and were given in marriage. Wise men foresaw the deluge, but people who were already half-starved every summer did not think their case could well be worse. In 1845 the population had swelled to 8,295,061, the greater part of whom depended on the potato only. There was no margin, and when the "precarious exotic" failed an awful famine was the result.

Great public and private efforts were made to meet the case, and relief works were undertaken, on which, in March, 1847, 734,000 persons, representing a family aggregate of not less than 3,000,000, were employed. It was found that labor and exposure were not good for half-starved men. The jobbing was frightful, and is probably inseparable from wholesale operations of this kind. The policy of the government was accordingly changed, and the task of feeding a whole people was undertaken. More than 3,000,000 rations, generally cooked, were at one time distributed, but no exertions could altogether avert death in a country where the usual machinery for carrying, distributing, and preparing food was almost entirely wanting. From 200,000 to 300,000 perished of starvation or of fever caused by insufficient food. An exodus followed which, necessary as it was, caused dreadful hardship, and among the Catholic Irish in America Fenianism took its rise.

Great brutalities disgraced the rebellion of 1798, but the people had suffered much and had French examples before them. The real originator of the movement was Theobald Wolfe Tone, whose proffered services were rejected by Pitt, and who founded the United Irishmen. His Parisian adventures, detailed by himself, are most interesting, and his tomb is still the object of an annual pilgrimage. Tone was a Protestant, but he had imbibed socialist ideas, and hated the priests, whose influence counteracted his own. In Wexford, where the insurrection went farthest, the ablest leaders were priests, but they acted against the policy of their church.

The inevitable Union followed (January 1, 1801). Pitt had long before (1785) offered a commercial partnership which had been rejected on the ground that it involved the ultimate right of England to tax Ireland. He was not less liberally inclined in religious matters, but George III. stood in the way, and like William III. the minister would not risk his imperial designs. Carried in great measure by the same corrupt means as the constitution of '82 had been worked by, the Union earned no gratitude. But it was a political necessity, and Grattan never gave his countrymen worse advice than when he urged them to "keep knocking at the Union." The advice has, however, been taken. Emmet's insurrection (1803) was the first emphatic protest. Then came the struggle for emancipation. It was proposed to couple the boon with a veto on the appointment of Roman Catholic bishops. It was the ghost of the old question of investitures. The remnant of the Catholic aristocracy would have granted it; even Pius VII. was not invincibly opposed to it; but Daniel O'Connell took the lead against it. Under his guidance the Catholic association became a formidable body. At last the priests gained control of the elections; the victor of Waterloo was obliged to confess that the king's government could no longer be carried

on, and Catholic emancipation had to be granted (1829). The tithe war followed, and this most oppressive of all taxes was unfortunately commuted (1838) only in deference to clamor and violence. The repeal agitation was unsuccessful, but let us not be extreme to mark the faults of O'Connell's later years. He doubtless believed in repeal at first; probably he ceased to believe in it, but he was already deeply committed, and had abandoned a lucrative profession for politics. With some help from Father Mathew he kept the monster meetings in order, and his constant denunciations of lawless violence distinguish him from his imitators. His trial took place in 1844. There is a sympathetic sketch of O'Connell's career in Lecky's *Leaders of Opinion*; Wyse's *History of the Catholic Association* gives the best account of the religious struggle, and much may be learned from Fitzpatrick's *Life of Bishop Doyle*.

The national system of education introduced in 1833 was the real recantation of intolerant opinions, but the economic state of Ireland was fearful. The famine, emigration, and the new poor law have nearly got rid of starvation, but the people have not become frankly loyal, for they feel that they owe more to their own importunity, to their own misfortunes, than to the wisdom of their rulers. The literary efforts of Young Ireland eventuated in another rebellion (1848); a revolutionary wave could not roll over Europe without touching the unlucky island. After the failure of that wretched outbreak there was peace until the close of the American war released a number of adventurers trained to the use of arms and filled with hatred to England.

Already in 1858 the discovery of the Phoenix conspiracy had shown that the policy of Mitchel and his associates was not forgotten. John O'Mahony, one of the men of '48, organized a formidable secret society in America, which his historical studies led him to call the Fenian brotherhood. The money raised in the United States was perhaps not less than £80,000 (\$400,000), but it is due to O'Mahony to say that he died poor. In Ireland the chief direction of the conspiracy was assumed by James Stephens, who had been implicated in the Phoenix affair, and who never cordially agreed with O'Mahony. Stephens was very despotic—a true revolutionary leader. As in all Irish political conspiracies, there were traitors in the camp, who kept the authorities well informed, and in September, 1865, the *Irish People* newspaper, which had been the organ of the movement, was suddenly suppressed by the government. The arrests of Luby, O'Leary, and O'Donovan Rossa followed, all of whom, with many others, were afterward prosecuted to conviction. Stephens for a time eluded the police, living with little concealment in a villa near Dublin, and apparently occupied in gardening. But in November he was identified and captured, much evidence being found in his house. Ten days afterward he escaped from Richmond prison, and it is now known that some of the warders were Fenians. Another conspirator, sometimes called O'Brien and sometimes Osborne, afterward escaped from Clonmel jail. American papers stated that Stephens was in actual want in New York in the winter of 1880, but he has since been heard of at Paris. The promptitude of the government perhaps prevented a general insurrection, but there was a partial outbreak in February and March, 1867, chiefly in Kerry, Limerick, and Tipperary. There was an affray, if it deserves the name, at Tallaght near Dublin, and a plot to seize Chester Castle was discovered and frustrated. The police, who behaved extremely well, were often attacked, but the Fenians abstained from plunder or from any acts which might estrange the rural population. The peasants, however, though for

the most part nationalists, did not care to risk their lives in such a wild enterprise, and the young men of the towns furnished the only real force. Weather of extraordinary severity, which will long be remembered as the "Fenian winter," completed their discomfiture, and they suffered fearful hardships. There was enough sympathy with the movement to procure the election of O'Donovan Rossa for Tipperary in 1867, when he was actually undergoing penal servitude. John Mitchel, whose old sentence was unreversed, was chosen by the same constituency as late as 1875, but in neither case was the vote a large one. It became the fashion in Ireland to celebrate annually the obsequies of the "Manchester martyrs," as the three Fenians were called who suffered death for the murder of Police-sergeant Brett. The Roman Catholic Church has always opposed secret societies, and some priests had the firmness to discountenance these political funerals, but strong popular excitement in Ireland has generally been beyond clerical control.

The Fenian movement disclosed much discontent, and was attended by criminal outrages in England. The abolition of the Irish Church Establishment, which had long been condemned by public opinion, was then decreed (1869). The land question was next taken in hand (1870). Then followed the rise of the Home Rule party, at first under the leadership of Dr. Isaac Butt, afterward to pass into the stronger hand of Charles Stewart Parnell. In 1874 the policy of obstruction was fully inaugurated at Westminster. Bad seasons and agrarian distress added force to the Land League. The British Government continued its policy of compromise legislation accompanied by coercion bills. Under the latter, law became the will of the Chief Secretary, and the leaders of the Irish cause in parliament were jailed without warrant and held without trial. The Tory House of Lords by the rejection of the "Compensation for Disturbance" bill again recorded itself on the wrong side. The well-meant efforts of Mr. Gladstone to ameliorate the condition of Ireland were blocked by the bigoted Tories and the hide-bound bourgeois, and by a combination with the so-called Liberal Unionists remedial legislation was again postponed. Now, in 1890, the Salisbury government has finally offered a bill containing its panacea for the troubles of Ireland, but which is looked upon with the suspicion naturally attaching to a gift from such a source.

IRELAND, SAMUEL, the dupe of his son, the subject of the following article, in the publication of the supposed Shakespearean papers, was born in London, where he was originally a mechanic at Spitalfields. He afterward became a dealer in old books and prints and similar articles; and, turning his knowledge of drawing and engraving to account, he published several books of travel, with illustrations in aquatint. On December 24, 1796, Ireland published the *Miscellaneous Papers and Legal Instruments under the Hand and Seal of William Shakspeare; including the Tragedy of King Lear and a small fragment of Hamlet*, dated 1797, and purporting to be copies of originals furnished him by his son. Although, on the exposure of the fraud, the latter asserted his father's complete innocence, Samuel Ireland felt the disgrace very bitterly, and the occurrence is said to have hastened his death, which took place in July, 1800.

IRELAND, SAMUEL WILLIAM HENRY, generally known as William Henry Ireland, who at the age of seventeen produced the notorious Shakespeare forgeries, was the son of the subject of the last notice, and was born in London in 1777. After spending four years at school in France, he was apprenticed in 1794 to a conveyancer in London. The enthusiasm of his father for

everything connected with Shakespeare suggested to young Ireland the idea of delighting him with a forged autograph of the poet. He carefully drew up a copy of an old deed, purporting to be a lease from Shakespeare to certain other parties, and presented it as a genuine document to his unsuspecting father. The complete success of this first attempt and the eager solicitations of his friends to ransack the papers among which he pretended to have found the lease were the incitements to a more ambitious career of literary forgery. He invented a story of a gentleman, accidentally met with, among whose old papers the documents were found, but who, for various reasons, refused to permit his name to be disclosed. A large collection of the most interesting relics was brought to light. A profession of faith, a love-letter, inclosing a lock of the poet's hair, to Anne Hathaway, private letters to and from Shakespeare, theatrical memoranda, notes of hand and receipts, agreements between Shakespeare and actors, pictures, annotated books and tracts—all were produced and received with delighted credulity. Doctor Parr, Doctor Wharton, Sir Isaac Heard, James Boswell, and others came to register their belief in the authenticity of the papers. The assurance with which the imposture was conducted may be judged from the fact that a deed was brought forward, in which it was set forth that the papers and books had been bequeathed by Shakespeare to a certain contemporary William-Henry Ireland, who had rescued him from drowning in the Thames, and who, there was evidence to show, was the direct ancestor of the Ireland whom chance had thrown in the way of the possessor of the relics. At last a whole new play, named *Vortigern*, was announced as having been discovered. Sheridan purchased it for Drury Lane Theater, and an overflowing house assembled to sit in judgment upon it. But away from the glamour of crabbed handwriting and yellow paper, the feeble dialogue and crude conceptions of the tragedy could not stand the test, and one representation sufficed to prove it a complete failure. Its fate prevented the composition of a series of historical plays, of which *Henry II.* had already been produced by the impudent Ireland. Samuel Ireland the elder had published the miscellaneous papers in what he asserts to have been the fullest belief in their authenticity, but the hostile criticism of Malone and others, and the unsatisfactory account of the source of the papers, combined to compel him to demand a full disclosure from his son. Harassed by the success of his own deceit, which had carried him far beyond his first intention, Ireland at last confessed his fraud, and published a tract with a full account in 1796. In 1805 he published more elaborate *Confessions*, in which he cannot conceal his satisfied vanity. After the exposure, Ireland was forced to abandon both his home and his profession. He wrote several novels of no value, and gradually sank to the condition of a bookseller's hack. He died in great penury in April, 1835.

IRENÆUS, bishop of Lyons in the end of the second century, was one of the most distinguished of the theologians of the ante-Nicene church. Very little is known of his early history, and the accounts given in various biographies are for the most part conjectural. He himself has informed us that in his youth he was acquainted with Polycarp, the disciple of John, and from this fact, together with his Greek name, his early and thorough Christian training, and his great acquaintance with Greek literature, it has been conjectured that he belonged to the neighborhood of Smyrna in Asia Minor, and that he was the child of Christian parents. It is most probable that he died in the year 202, but the date of his birth is quite uncertain; the best authorities place it between 120 and 140. How he, born and educated

in Asia Minor, came to spend his life in Gaul is also unknown. Eusebius tells us that he was a presbyter of Pothinus, bishop of Lyons, and it has been inferred from that passage that he was ordained by that bishop. Irenæus was best known by his endeavors to counteract the teachings of the Gnostics, and his attempts to mediate between the bishops of Rome and the churches of Asia Minor in their disputes about the proper time at which to keep Easter. Gregory of Tours is our authority for saying that Irenæus died a martyr in the persecution under Severus; but, as this fact is not mentioned by Tertullian, Augustine, Eusebius, Theodoret, and other early writers, it is considered doubtful by most modern scholars. His death, whether crowned with the honor of martyrdom or not, must have taken place near the beginning of the third century. Gregory tells us that the bones of Irenæus were buried under the altar of the church at Lyons. The story that they were dug up and thrown into the street by the Calvinists in 1562 has been abundantly refuted.

IRENE (752-803) was the wife of Leo IV., emperor of the East. A poor but beautiful Athenian orphan, she speedily added the confidence to the love of her feeble husband, and at his death in 780 was left by him sole guardian of the empire, and of their young son Constantine VI. Seizing the supreme power in the name of the latter, Irene's first endeavors were to revive the orthodox image-worship, which she had secretly cherished, although compelled solemnly to abjure it in the lifetime of her iconoclastic father-in-law and husband. In 784 she obtained the elevation of Tarasius, a partisan of her own, to the patriarchate; and, at first suffering the laws against image-worshippers to fall into disuse, she assembled a council of clergy at Nicæa in 787 to discuss the whole question anew. Under the auspices of a ruler whose wishes were so clearly known, the decision of this second council of Nice could take only one direction, and the Iconoclasts were hurled from their supremacy. So long as Constantine remained a child, Irene was able to combine his interests and her own, and to rule wisely and faithfully; but as the prince approached maturity he began to grow restive under her autocratic sway. The discontent which this occasioned swelled in 790 into open resistance, and the soldiers, headed by the Armenian guard, formally proclaimed Constantine VI. as the sole ruler. A hollow semblance of friendship was maintained between Constantine and Irene, whose title of empress he confirmed in 792; but the court, the army, and the capital were divided between rival factions, and that which supported the mother against her son grew daily in number and strength. Constantine perceived his danger too late to avert it; and when he saw the conspiracy ripe for action he could only flee for aid to the provinces. But even there he was surrounded by those who were already too deeply implicated in treason to refuse to complete their perfidy. Seized by his attendants on the Asiatic shore of the Bosphorus, the emperor was carried a captive back to the palace at Constantinople; and there, by the orders of his inhuman mother, in the very porphyry chamber where he first saw the light, his eyes were stabbed out by fierce blows of a murderous dagger. In 802 the patricians, upon whom she had lavished every honor and favor, conspired against her, and placed the avaricious Nicephorus on the throne. The haughty and unscrupulous princess, "who never lost sight of political power in the height of her religious zeal," who, hailed by the church as a second Helena, the mother of another great Constantine, had revealed herself to the world as a second Athaliah, was forced in her exile in Lesbos to support herself by the daily toil of her distaff. She died the following year. Her

religious zeal has given her a place among the saints of the Greek Church.

IRETON, HENRY, Parliamentary general, was the eldest son of German Ireton of Attenton in Nottinghamshire, and was born in 1610. After graduating B.A. at Oxford, he entered the Middle Temple, London, as a student of law; but on the outbreak of the civil war he joined the Parliamentary army, in which his technical mastery of the military art gave him rapid promotion and helped him to obtain the special favor of Cromwell. On the formation of the "new model" he was appointed captain in Sir Robert Pye's regiment. Shortly before the battle of Naseby, in June, 1645, he was promoted to a colonelcy, and on the eve of the battle he was on the suggestion of Cromwell made commissary-general and appointed to the command of the left wing, Cromwell himself commanding the right. The wing under Ireton was completely broken by the impetuous charge of Rupert, and Ireton was taken prisoner, but after the rout of the enemy which ensued on the successful charge of Cromwell he regained his freedom. He was present at the siege of Bristol in the September following, and he took an active part in the subsequent victorious campaign which resulted in the overthrow of the royal cause. While occupied with the siege of Oxford he was, in June 15, 1646, married at Holton House, five miles distant from the city—and at that time probably the headquarters of Fairfax—to Bridget, daughter of Oliver Cromwell. In the negotiations of the army with the Parliament, and in the conferences with the king, he took a leading part, being the person chiefly intrusted with the drawing up of the army papers, including the heads of proposals from the army to the king. He is said to have been one of the principal instigators of the trial of the king, and was one of the most zealous advocates of his execution. The regiment of Ireton having been chosen by lot to accompany Cromwell in his Irish campaign, Ireton was appointed major-general; and on the recall of his chief to take the command in Scotland he remained with the title and powers of lord-deputy to complete the work of reduction. This he proceeded to do with his usual energy, and as much by the severity of his methods of punishment as by his military skill was rapidly bringing his task to a close, when during the siege of Limerick he died, November 26, 1651, of an inflammatory fever, the result, in all probability, of exhaustion and exposure.

IRIARTE, or YRIARTE, TOMAS DE, Spanish poet of the age of Charles III. was born on the Isle of Teneriffe in 1750 and died in 1791.

IRIDIUM, one of the metals of the platinum group, has recently acquired increased importance from its employment in alloy with platinum in the construction of the international standards of length and weight. Its separation from the associated metals is a matter of very considerable difficulty, and involves a long series of operations. In practice, even when prepared with the utmost care, it still contains a minute though almost inappreciable amount of oxygen, rhodium, ruthenium, and possibly iron.

IRIS, the rainbow, was personified as one of the secondary deities of Olympus, and occurs very frequently both in art and in literature. As the rainbow unites earth and heaven, Iris is the messenger of the gods to men; in this capacity she is mentioned frequently in the *Iliad*, but never in the *Odyssey*, where Hermes takes her place. According to Hesiod she is the daughter of Thaumas and Electra and sister of the Harpies, the stormwinds.

IRIS. The iris flower belongs to the natural family *Iridaceæ*, of the class monocotyledons, and to the petaloid division with inferior ovary and only three sta-

mens (the outer series), being thus distinguished from the *Amaryllis* family, which has six stamens. They are handsome showy-flowered plants, the Greek name iris having been applied on account of the hues of the flowers. Two of the species are British—*I. Pseudacorus*, or yellow flag, and the *I. fetidissima*, the fetid iris or roast-beef plant, with blue-purple rarely yellow flowers. The former species is widely distributed; the latter is English, although naturalized in Scotland and Ireland. The roasted seeds of *I. Pseudacorus* have been used as a substitute for coffee. *Iris florentina*, with white or pale blue flowers, is a native of the south of Europe, and is the source of the violet-scented orris root used in perfumery. *Iris versicolor*, or blue flag, is indigenous to North America, and yields "iridin," a powerful hepatic stimulant.

IRISH MOSS, or CARRAGEEN, is a seaweed which grows abundantly along the rocky parts of the Atlantic coast of Europe and North America. It is collected for commercial purposes on the west and northwest of Ireland, and in very large quantities on the coast of Plymouth county, Massachusetts. In its fresh condition the plant is soft and cartilaginous, varying in color from a greenish-yellow to a dark purple or purplish-brown; but when washed and sun-dried for preservation it has a yellowish, translucent, horn-like aspect and consistency. The principal constituent of Irish moss is a mucilaginous body, of which it contains about 55 per cent.; and with that it has nearly 10 per cent. of albuminoids and about 15 per cent. of mineral matter rich in iodine and sulphur. When softened in water it has a sea-like odor, and from the abundance of its mucilage it will form a jelly on boiling with from twenty to thirty times its weight of water. The jelly of Irish moss is used as an occasional article of food, and is a popular remedy in cases of chest disease. It may also be used as a thickener in calico-printing, and in America it is used for fining beer. In the neighborhood where it is obtained it is utilized for feeding cattle.

IRISH SEA, a body of water lying between the north of Ireland and the north of England, with the southwestern counties of Scotland on the north. It is connected with the Atlantic on the northwest by the North Channel and on the south by St. George's Channel. Between the coasts of Louth (Ireland) and Lancaster the Irish Sea has a width of 150 miles; its greatest length north and south is about the same. Within its boundaries lie the Isle of Man and Anglesey, with Holyhead Island.

IRKUTSK, a government of Asiatic Russia, extending over an area of 272,140 square miles of eastern Siberia, and bounded by the Yenissei and Yakutsk governments, the Trans-Baikal region, and the Chinese frontier. It is divided into the districts of Kirensk, Nizhne-Udinsk, Irkutsk, Verkholsk, and Balagansk.

IRKUTSK, the chief town of the government of the same name, is under various aspects the most important place in all Siberia, being not only the greatest center of population and principal commercial depot to the north of Tashkend, but the residence of the governor-general, a fortified military post, an archbishopric, and the seat of several learned societies. It is 3,780 miles from St. Petersburg. The town proper lies on the right bank of the Angara, a tributary of the Yenissei, and on the opposite bank is the Glaskovsk suburb. The river, which has a breadth of 1,890 feet, is crossed by a flying bridge. Irkutsk has long been reputed a remarkably fine city for such an outlying situation—its streets being straight, broad, well paved, and well lighted; but in 1879, on June 22d and 24th (July 4th and 6th), the greater proportion of its houses being of wood, the central and most important part fell a prey to a great conflagration. The palace of the governor

general, the principal administrative and municipal offices, and many of the other public buildings were destroyed; and the government archives, the admirable library (10,000 vols.) and museum of the Siberian section of the Geographical Society, with minor collections of the same kind, were utterly ruined. The total loss was estimated at 30,000,000 rubles. A cathedral (built of wood in 1693 and rebuilt of stone in 1718) and twenty-three other Orthodox churches, a fine gymnasium, a school of medicine, a museum, a theater, a town hospital and a military hospital, an orphan asylum, an infirmary, the penitentiary, and the crown factories, are among the public institutions and buildings. Population (1890), 16,000.

The origin of Irkutsk is to be found in the winter quarters established by Ivan Pokhaboff for the collection of the fur tax from the Buriats. Its existence as a town dates from 1686. The first church, that of our Saviour, and the monastery of the Ascension, $3\frac{1}{2}$ miles from the town, were built in 1672, and that of the Apparition of the Virgin in 1693. It was in 1731 that the town was made the administrative center of the Irkutsk province, and its position as chief town of the government dates from 1764. Its population, which was about 6,500 at the time of Gmelin's visit (1740), had increased to 16,569 by 1838, and to 24,779 in 1862 (12,639 males). An elaborate census taken in 1875 gave 18,076 males and 14,436 females, a total of 32,512. This increase is wholly produced by immigration; for the death-rate always considerably exceeds the birth-rate, a fact easily explained by the vast proportion of the unmarried classes,—public employés, soldiers, ecclesiastics, prisoners, and domestics, amounting to 12,876 in 1875.

IRNERIUS, a distinguished jurist, sometimes referred to as "lucerna juris," who taught the "free arts" at Bologna, his native city, during the earlier decades of the 12th century. Other forms of the name are Yrnerius, Hirnerius, Hyrnerius, Warnerius, Wernierius, Guarnerius, Gernerius, some of which have been held to be suggestive of a German origin. Of his personal history nothing is known, except that it was at the instance of the Countess Matilda, Hildebrand's friend, who died in 1115, that he directed his attention and that of his students to the *Institutes* and *Code* of Justinian; that after 1116 he appears to have held some office under the emperor Henry V.; and that he died, perhaps during the reign of the emperor Lothair II., but certainly before 1140. He was the first of the Glossators (see Gloss), and according to ancient opinion (which, however, has been much controverted in later times) was the author of the epitome of the *Novells* of Justinian, called the *Authentica*, arranged according to the titles of the *Code*. His *Formularium Tabellionum* (a directory for notaries) and *Quæstiones* (a book of decisions) are no longer extant. His position as the founder of all learned investigation into the laws of Justinian is an important one; and he and his school are generally held to present an almost brilliant contrast, not only with the law writers of the preceding, but also with the jurists of the latter part of the following, century.

See Savigny, *Gesch. d. Röm. Rechts im Mittelalter*, iii. 83; Vecchio, *Notizie di Irnerio e della sua scuola*, Pisa, 1869; and Ficker, *Forsch. z. Reichs-u. Rechtsgesch. Italiens*, vol. iii., Innsbruck, 1870.

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